

(Analysis Note #Run12pp510-xj1)

Run12pp510GeV Muon-Arm Data Quality Checks and the GoodRunLists

Xiaodong, Jiang updated on 10/26/2015

This analysis note covers details of Run12pp510 Muon-Arm Data Quality checks, GoodRunLists, MUID1D trigger efficiencies, and MUID_EFFiciency. Similar issues in Run15pp200 are addressed in a separated Analysis Note.

Data Samples and Event-Triggers used in this analysis:

- For MuTr and MuID detector performance checks and efficiency studies, events from all triggers are used (dominated by MUID1D triggered events).
- For MUID1D trigger efficiency studies, central-arm ERT, and MPC triggered events are used (to mimic the Min-Biased triggered events, which were not available due to heavily pre-scaled).
- For Yield studies of particles stopped in gap2, gap3, gap4, ERT triggered events are used in this analysis (to avoid known problems in MUID1D trigger efficiency).

All related information, including good_runlists, flagged_run_lists, run-by-run detector plots can be found at:

<https://www.phenix.bnl.gov/phenix/www/publish/xjiang/Run12/Run12pp510/>

Summary of Results and Conclusions

1. Issues related to MUID-Efficiency and MUID1D trigger efficiencies are identified. Pro and Cons of two-different methods of producing MUID-EFF are studied. A new solution of HV-based MUID-Eff method is applied. Areas of improvements are identified for existing data analysis and upcoming runs. Two methods are:
 - MUID_EFF Data-Driven Method using detector hit data: in each arm, plane, panel, tube (traditional method in PHENIX analysis since 2004).
 - MUID_EFF HV_method: based on dark-current drawn, calculated effective HV, and detector efficiency from a cosmic-ray High-Voltage-scan data of 2014.
2. MUID-Eff plots and tables are produced, tube-by-tube, panel-by-panel, gap-by-gap and run-by-run. Luminosity-weighted averaged MUID efficiency files are produced, according to each method for follow-up simulation studies, corresponding to the good runlists for different run-luminosity groups.
3. Results of a study of uncertainties of MUID_EFF are presented, corresponding to each run-luminosity groups. Although not completely independent, **the differences between the two method (FWHM $\pm 4\%$) are taken as systematic uncertainties.**
4. New Run12pp510 preliminary good run lists are produced based on MuTr and MUID detectors(FVTX and VTX data quality checks are much more time consuming due to frequent hardware issues during Run12pp510. Two Ph.D. students were assigned to perform this task as part of their Ph.D. thesis work).

The Detailed Item-by-Item List

- Run selection, run-groups in luminosity
- Data samples and Event-Trigger used in the analysis.
- MUID1D trigger efficiencies and data quality.
- MUID detector efficiencies, compare of Data-Driven Method and HV method. Studies of uncertainties.
- MuTr data quality
- FlaggedRunList and GoodRunLists

Part-I Run12pp510: Run Selection and Run-groups according to Luminosity

Run selection:

- Runs labeled as “PHYSICS”
- Trigger configuration: PP510Run...
- Run time > 600 sec.
- Number-of-Events in Run > 1000,000.
- No obvious hardware failures in end-run-comments.

Run-number vs Luminosity (see next page)

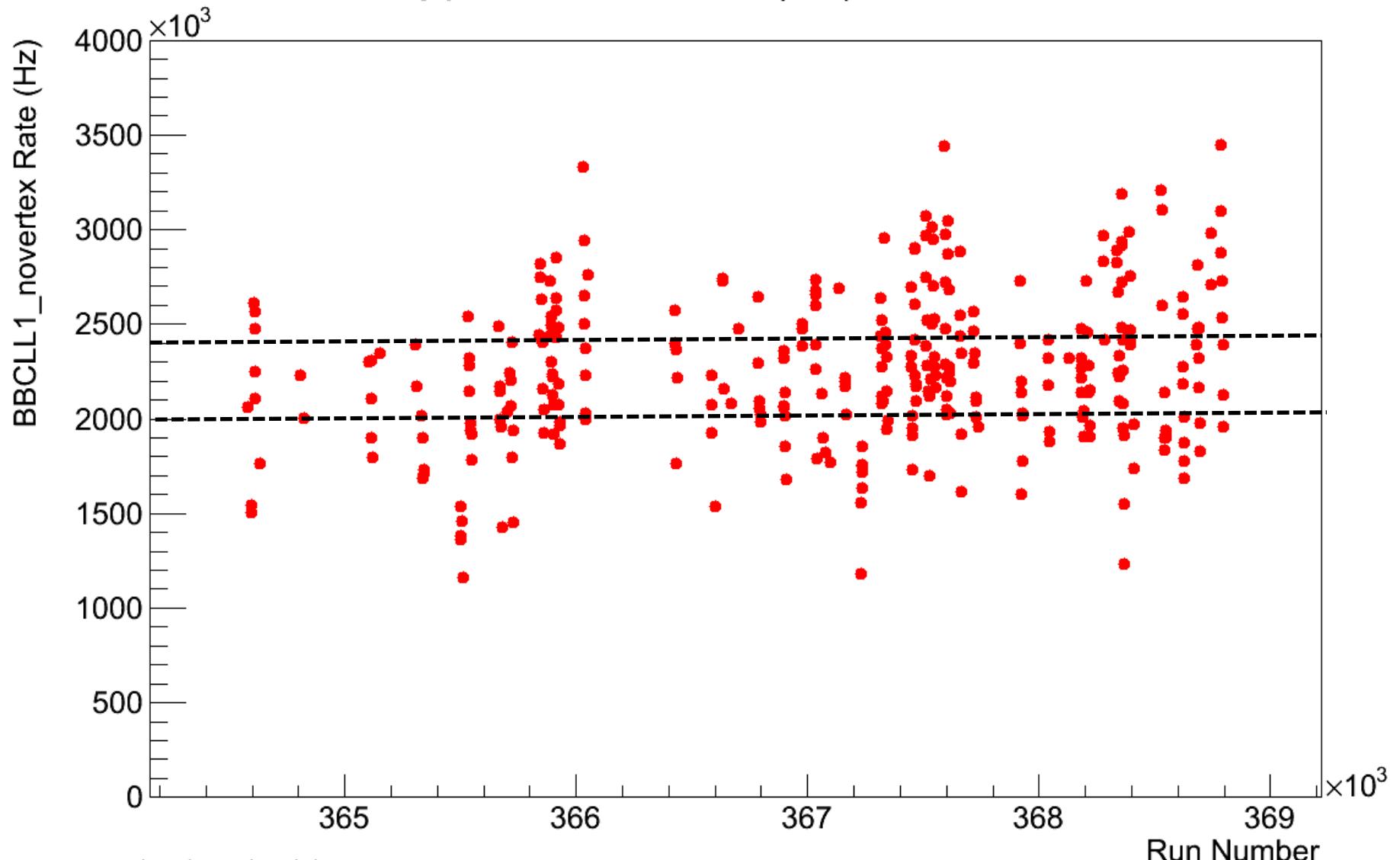
“Luminosity”=BBCLL1_novertex rate

Run-grouped into three luminosity groups.

Accepted Runs and Rejected Runs

go through run logbook and subsystem logbook, run-by-run.

Run12pp510 BBC Rate (Hz) vs Run Number



generic_lunlist_highlumi.txt 108 runs BBC_rate>2.4MHz
generic_lunlist_midlumi.txt 129 runs, in between
generic_lunlist_lowlumi.txt 81 run3, BBC_rate<2.0 MHz

Accepted Runs: 312+6=318 runs Generic_runlist.txt

Requesting runs of: Physics, #events >1000,000, runtime>600 sec.

#364580-#368798, accept 312 runs under Trigger Configuration PP510Run12.

(Taken 3/18/2012-4/18/2012).

Accept 6 runs under Trigger Configuration PP510Run12_MA

(central arm trigger disabled, Muon_Arm trigger Enable)

(Taken on 4/8/2012: 367515, 367517, 367521, 367526, 367530, 367531)

Rejected Runs:

Reject 366054, 366055, 366059, 366060, short runs under Trigger Configuration

PP510Run12_NOVTX_NOFVTX, PP510Run12_NOFVTX.

(Taken on 3/27/2012, ~100 minutes total)

Reject 368315, 368317, short runs under Trigger Configuration PP510Run12_MA.

(Taken on 4/14/2012, ~30 minutes total)

Reject 365111, a ZDC run listed as PHYSICS (taken on 3/20/2012).

Part-II Run12pp510: MUID1D Trigger Efficiency Studies

Conclusion: suffering a timing issue during Run12pp510, MUID1D trigger efficiencies were only at ~50% (South-Arm, ~75% North-Arm), with obvious momentum dependency. Yield-ratio studies, and hadron/muon ratio studies which explicitly require gap3/gap4 event-ratios should avoid using MUID1D trigger to start with, to avoid complications of introducing trigger-related-corrections in the initial steps, if all possible.

Run12pp510 Single-Muon Related Triggers

for Heavy Flavor Analysis (not including W-triggers which involve RPC3 and SG1)

“Minimum-Bias Type” Triggers:

Run368798 April 18th, 2012 (last run).

Name	Bit Mask	Scale Down	State	Raw Trigger Count	Raw Trigger Rate
BBCLL1(>0 tubes)	0x00000001	14559	Enabled	2373563700	1408643.15
BBCLL1(>0 tubes) novertex	0x00000002	6233	Enabled	4014044591	2382222.31
BBCLL1(>0 tubes) narrowvtx	0x00000010	3657	Enabled	1165871269	691911.73
(MUIDLL1_N1D S1D)&BBCLL1(noVtx)	0x00020000	41	Enabled	17611844	10452.13

Main muon-production: North and South MUID1D single-muon triggers are combined.

In commissioning mode, “high-momentum muon” triggers. Data not useful due to pre-scale:

MUON_S_SG3&MUIDLL1_S1D&BBCLL1(noVtx)	0x00080000	4	Enabled	637176	378.15
MUON_N_SG3&MUIDLL1_N1D&BBCLL1(noVtx)	0x00100000	20	Enabled	3121739	1852.66

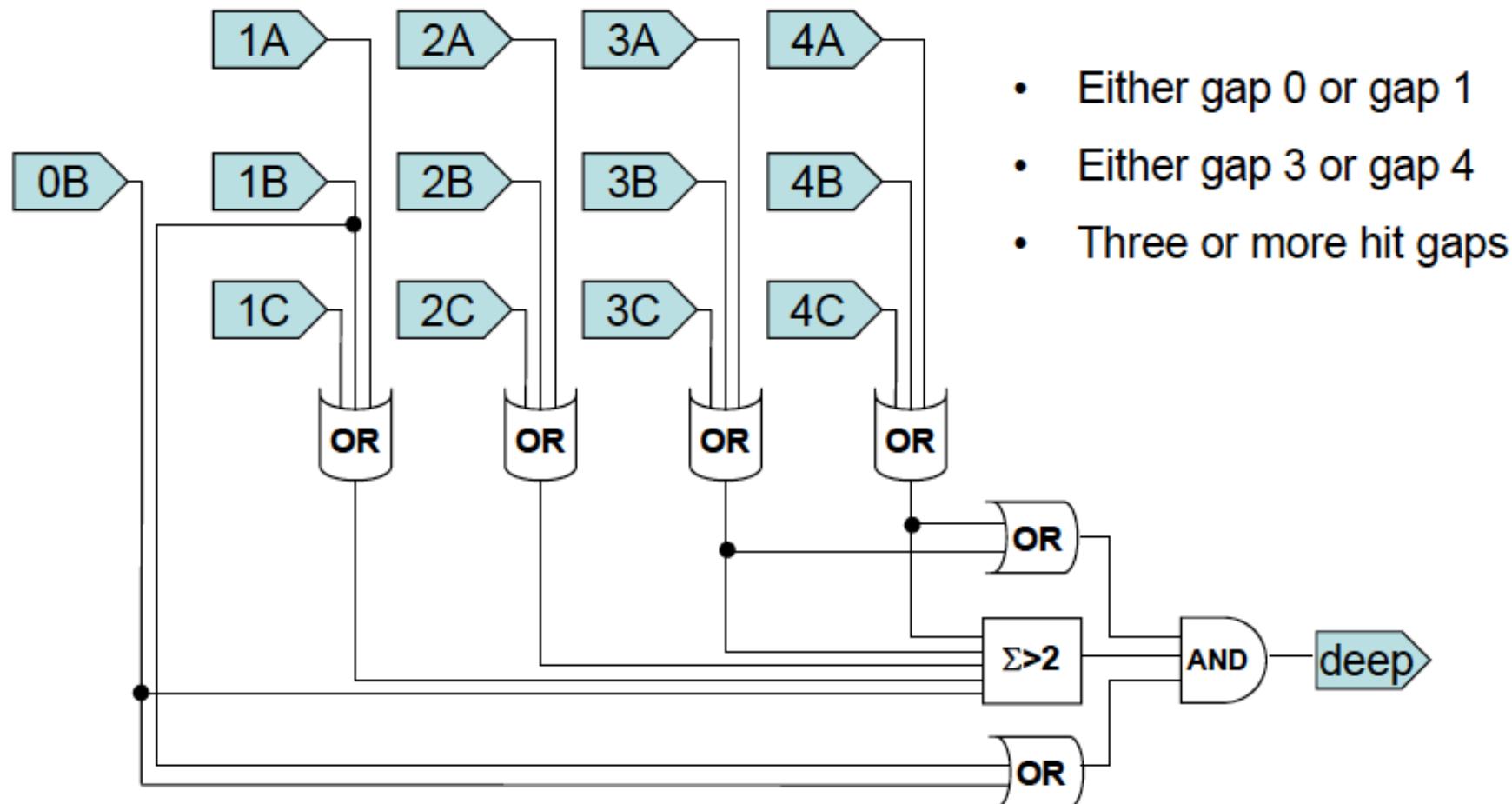
In addition, di-muon triggers:

((MUIDLL1_N2D S2D) ((N1D&S1D))&BBCLL1(noVtx)	0x00010000	0	Enabled	232970	138.26
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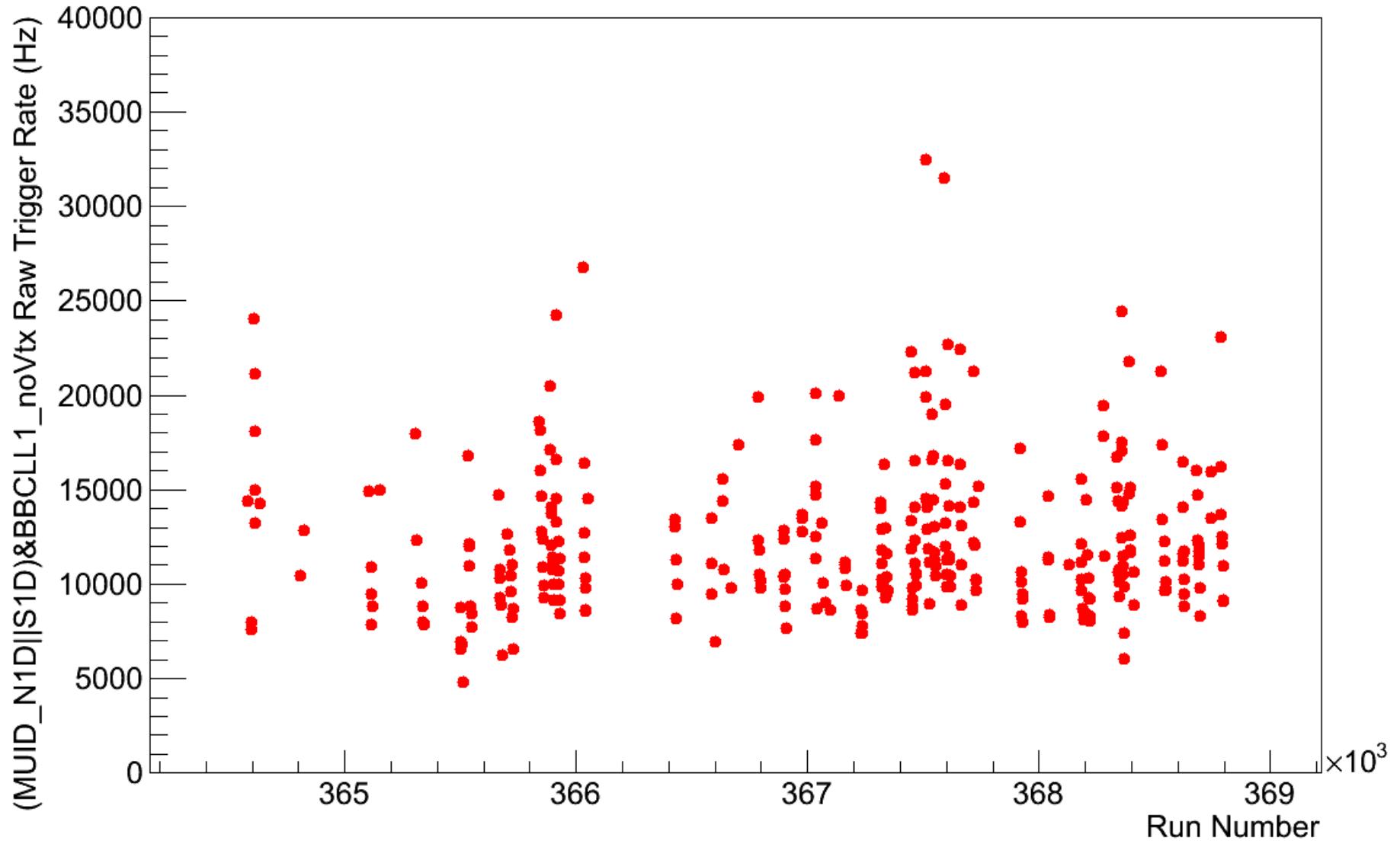
MUID1D trigger timing issue: It was well-known that in Run12pp510, MUID1D, MUID2D triggers suffered low eff due to timing issues. For example, South-Arm MUID1D eff was ~50%.

MUID1D Trigger Logic

MuID LL1 Deep Symset Logic

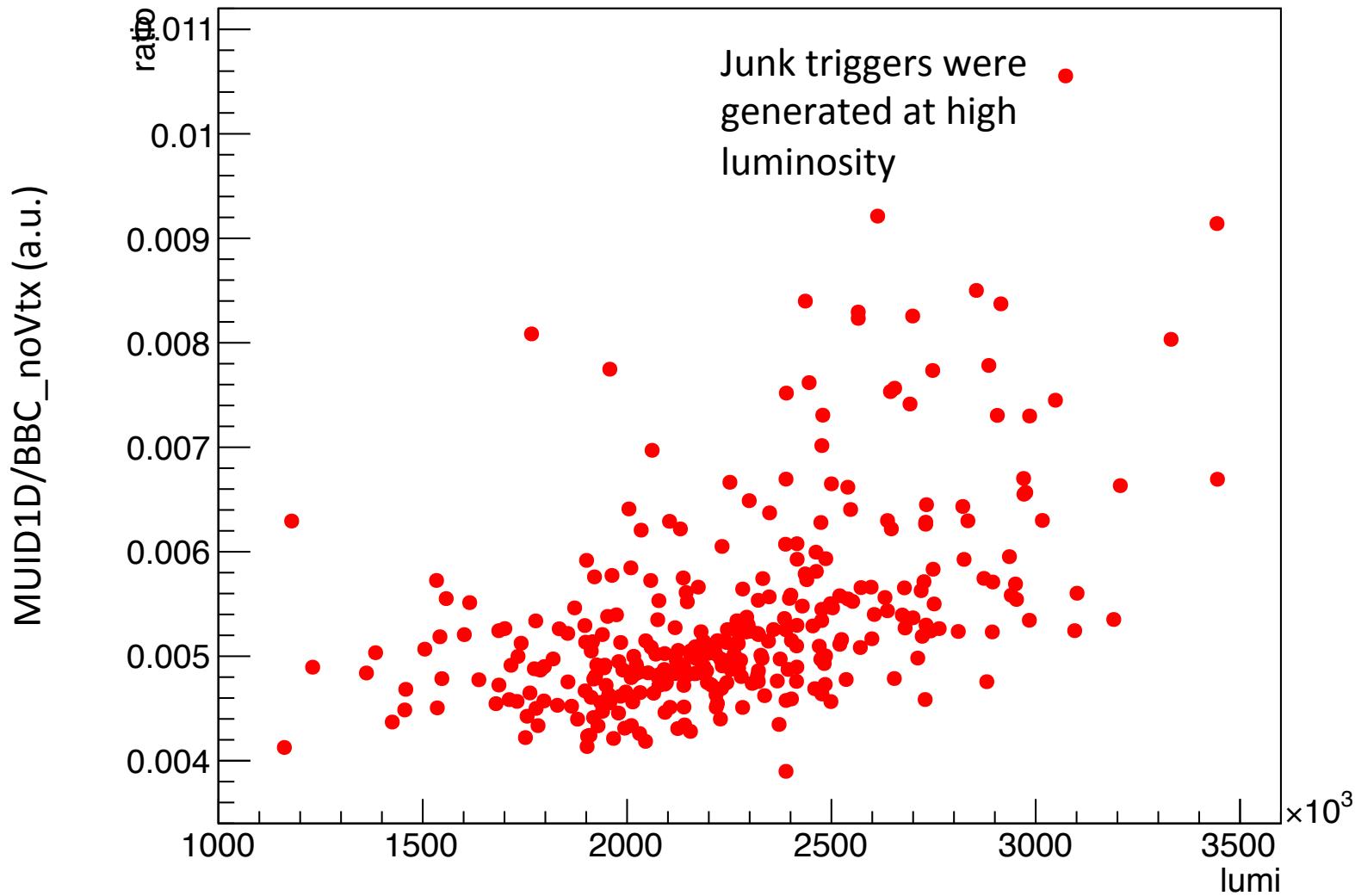


Run12pp510 MUID1D Raw Trigger Rate (Hz) vs Run Number



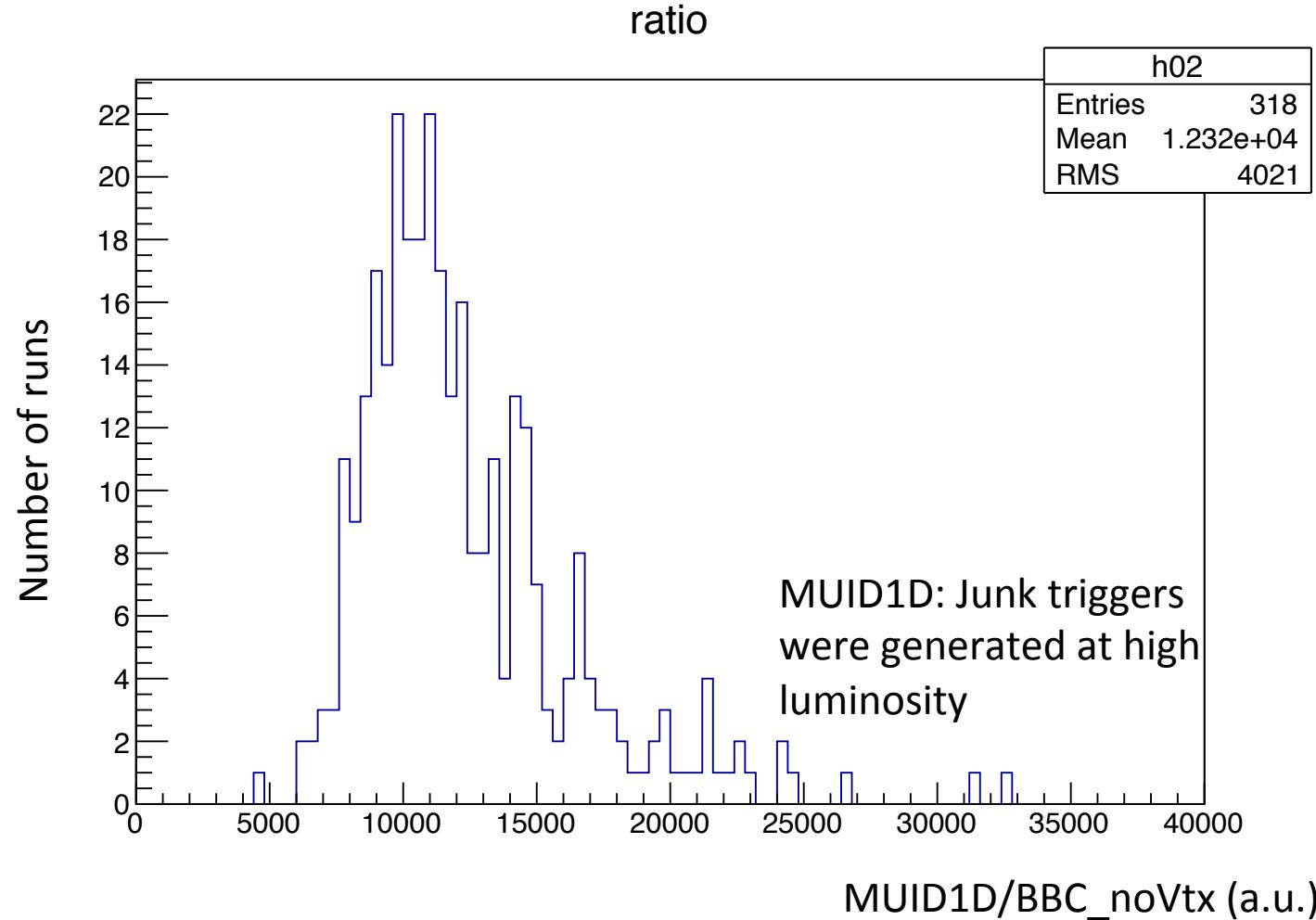
MUID1D-Trigger/per-unit-Luminosity: Not Flat

ratio:lumi



MUID1D-Trigger/per-unit-Luminosity: Not Flat, obvious luminosity dependency

Ratio: MUID1D_trigger/BBC_noVtx



Run12pp510 “Min-Bias” Triggers

“Minimum-Bias Type” Triggers:

Run368798 April 18th, 2012 (last run).

Name	Bit Mask	Scale Down	State	Raw Trigger Count	Raw Trigger Rate
BBCLL1(>0 tubes)	0x00000001	14559	Enabled	2373563700	1408643.15
BBCLL1(>0 tubes) novertex	0x00000002	6233	Enabled	4014044591	2382222.31
BBCLL1(>0 tubes) narrowvtx	0x00000010	3657	Enabled	1165871269	691911.73

BBCLL1 triggers were heavily pre-scaled

In stead, we use ERT, and MPC triggered events separately to substitute as “MinBias”

ERT_4x4b	0x00000040	0	Enabled	141630	84.05
ERT_4x4a&BBCLL1	0x00000080	0	Enabled	586234	347.91
ERT_4x4c&BBCLL1(narrow)	0x00000100	1	Enabled	2981249	1769.29
MPC_B	0x00001000	0	Enabled	503183	298.62
MPC_A	0x00002000	0	Enabled	1625848	964.89

MUID1D Trigger Efficiency from Data

Conclusion: suffering a timing issue during Run12pp510, MUID1D trigger efficiencies were only ~50% (South-Arm, ~75% North-Arm), with obvious momentum dependency. Yield-studies which require gap3/gap4 event-ratios should avoid using MUID1D trigger to start with to avoid complications of introducing trigger-related-corrections, if all possible.

Trigger Efficiency=(events-really-fired-trigger)/(events-should-fired-trigger)

MUID1D-flagged-in-data **Emulator-flagged-events**

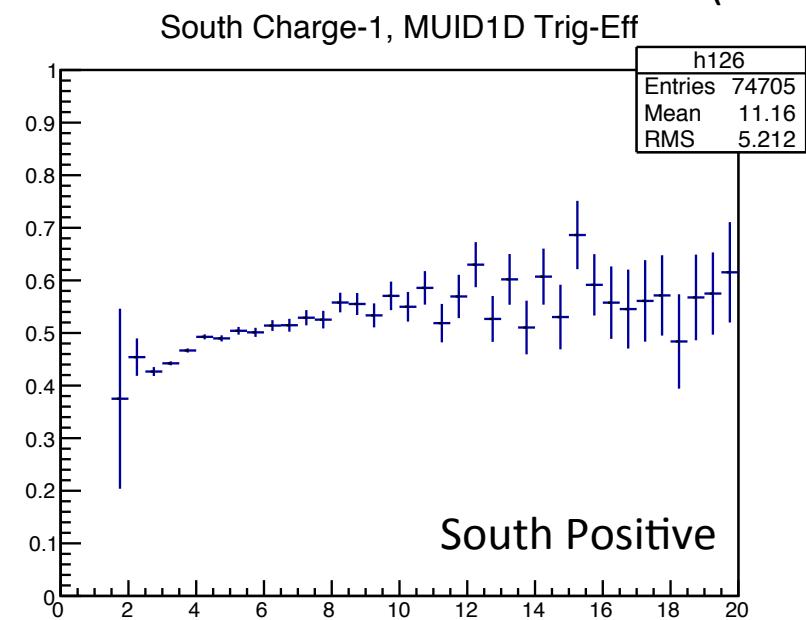
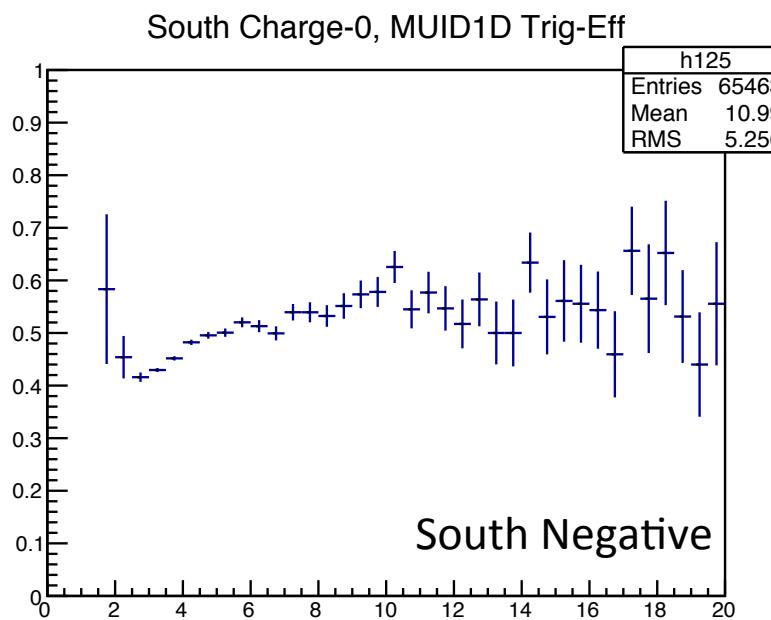
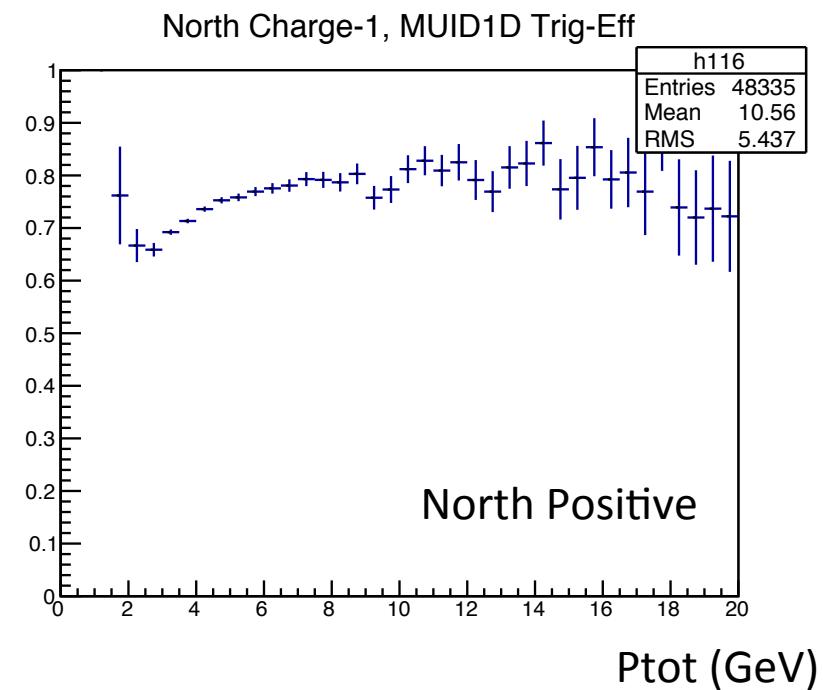
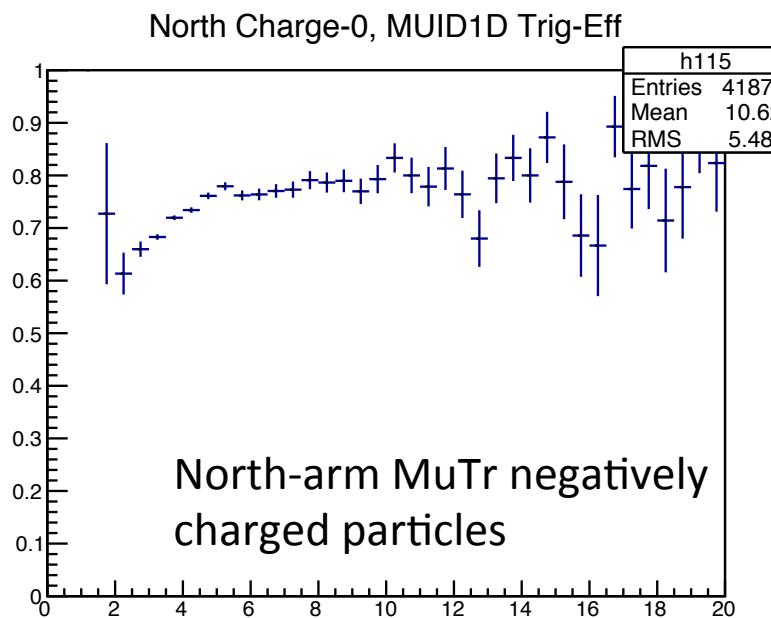
While studying MUID1D trigger efficiency, should use MUID unrelated triggered events, preferably the min-biased triggered events.

Run12pp510 had min-bias trigger heavily pre-scaled

Although not exactly independent, we decided to use ERT, and MPC triggered events separately to substitute as “Min-Bias Triggers” in MUID1D trigger efficiency studies.

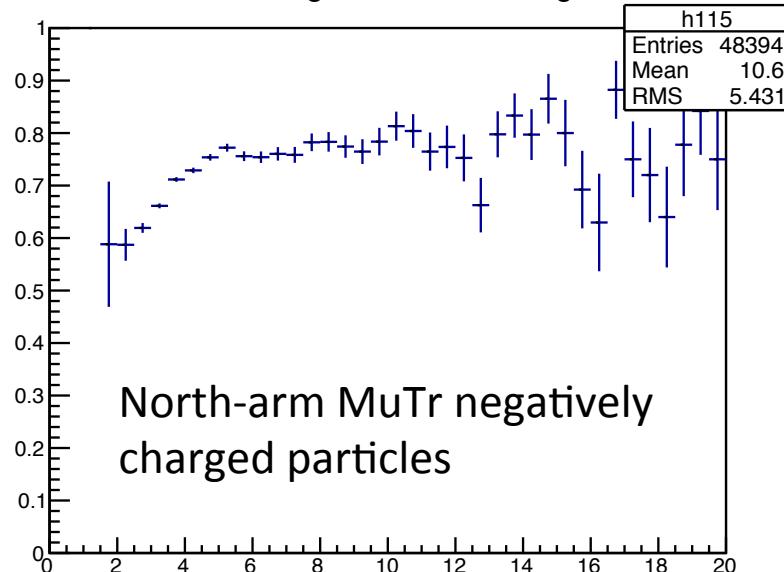
`MUID1D_Trig_Eff_in_Arm = (goodmuon&bbcnovTx&MUID1D)/
(goodmuons&bbcnovTx&MUID1D_Emulator)`

Good muons = (lastgap=3 or 4) & (tracking quality)&(1.2<|eta|<2.0)
(also checked for lastgap=4, results remains the same).

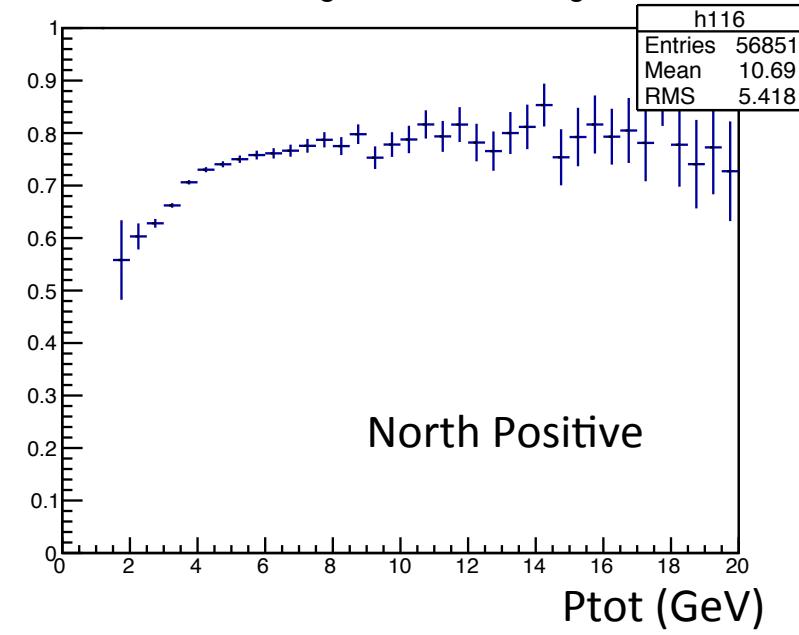


ERT Triggered “MB” events, if good mouns: lastgap=4

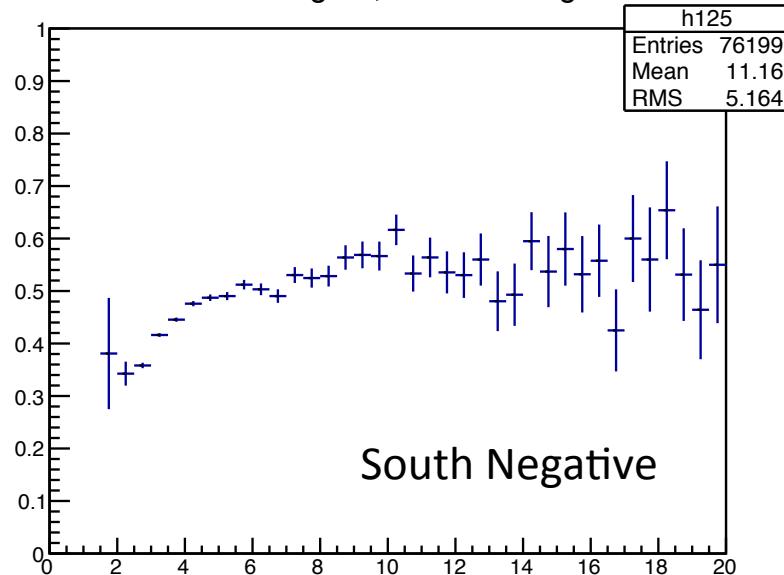
North Charge-0, MUID1D Trig-Eff



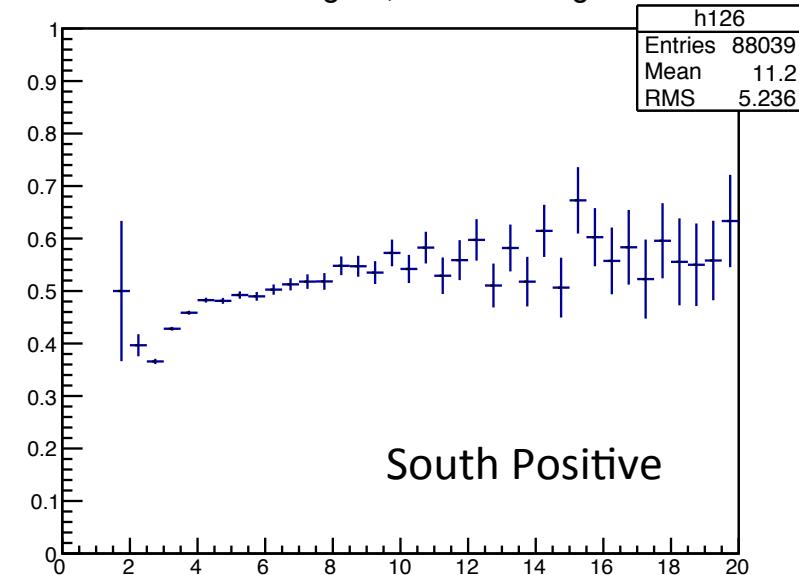
North Charge-1, MUID1D Trig-Eff



South Charge-0, MUID1D Trig-Eff

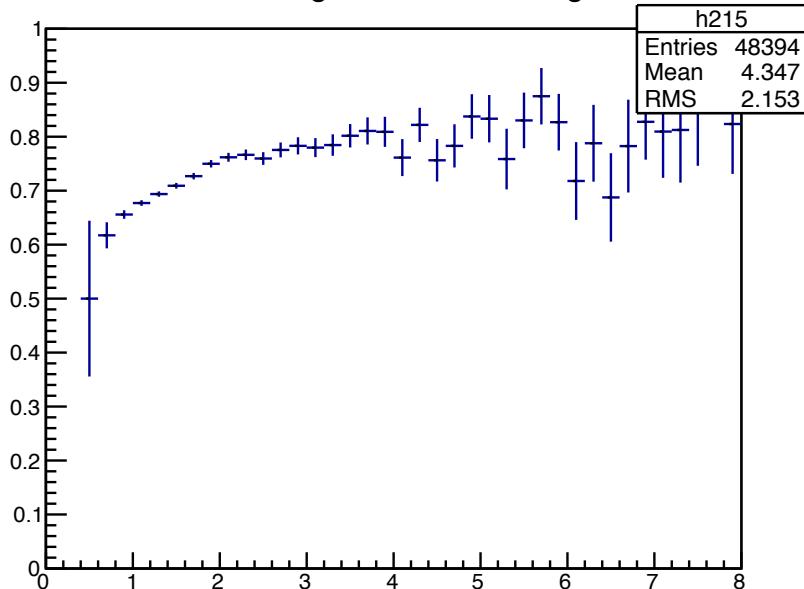


South Charge-1, MUID1D Trig-Eff

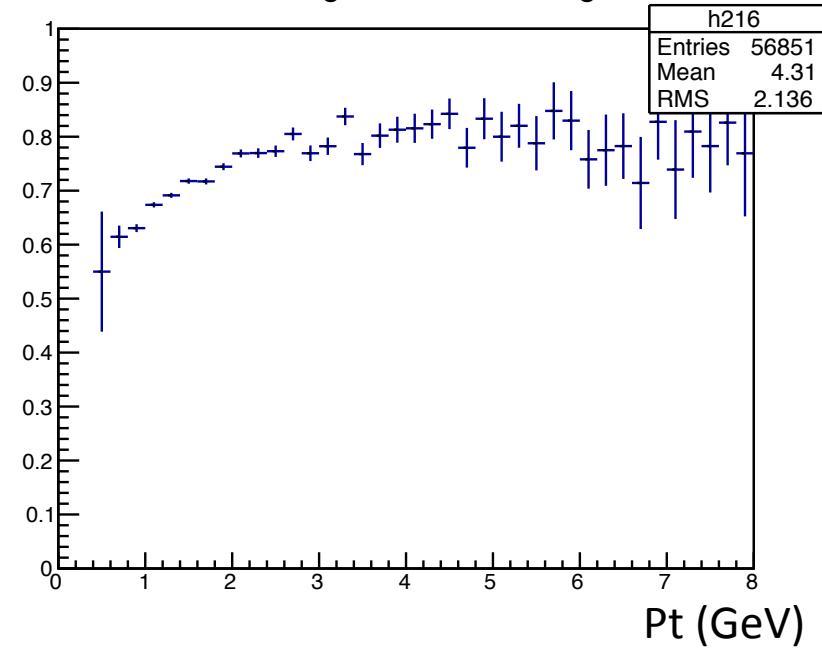


ERT Triggered “MB” events, if good mouns: lastgap=3 or 4

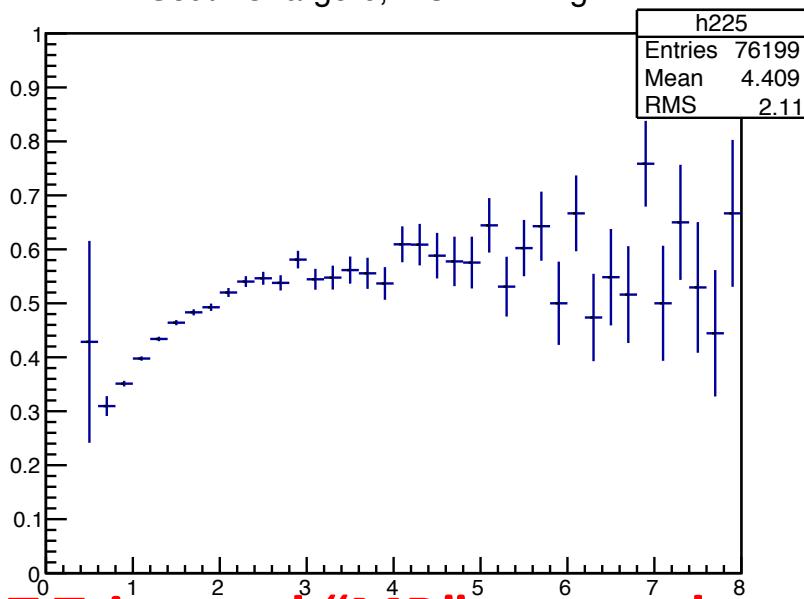
North Charge-0, MUID1D Trig-Eff



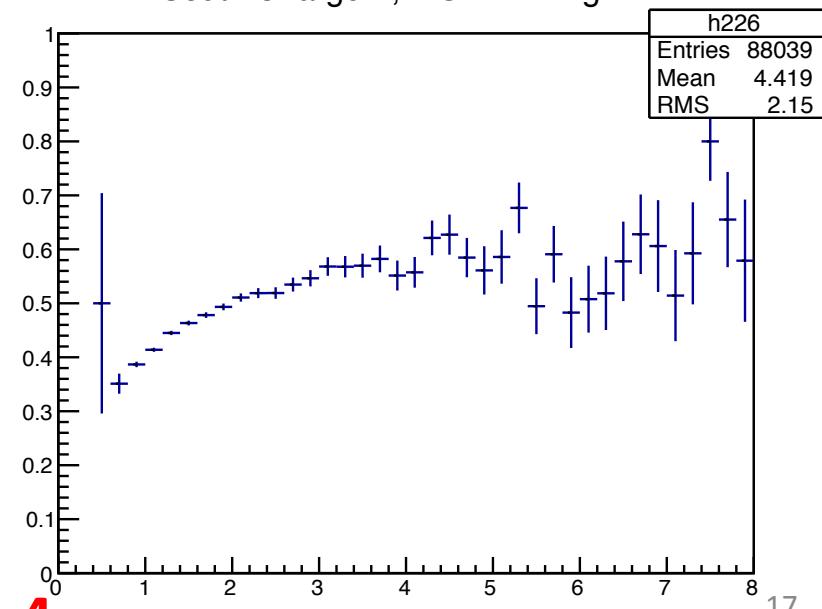
North Charge-1, MUID1D Trig-Eff



South Charge-0, MUID1D Trig-Eff

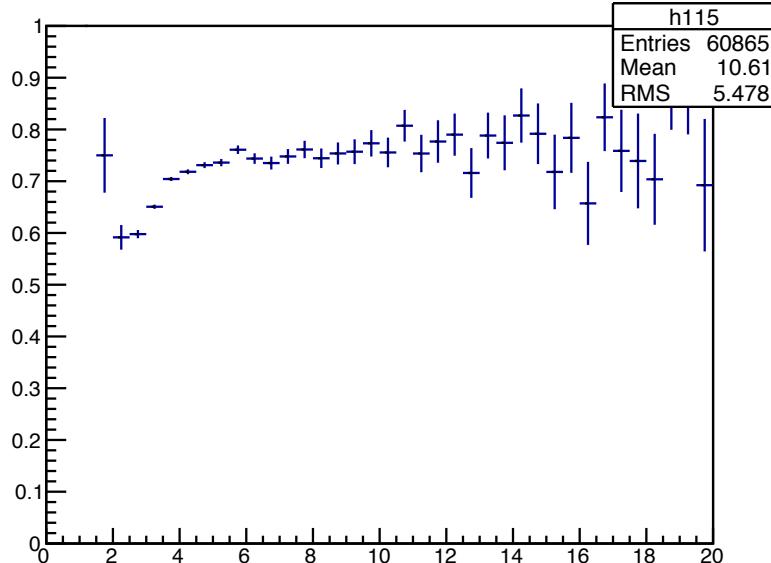


South Charge-1, MUID1D Trig-Eff

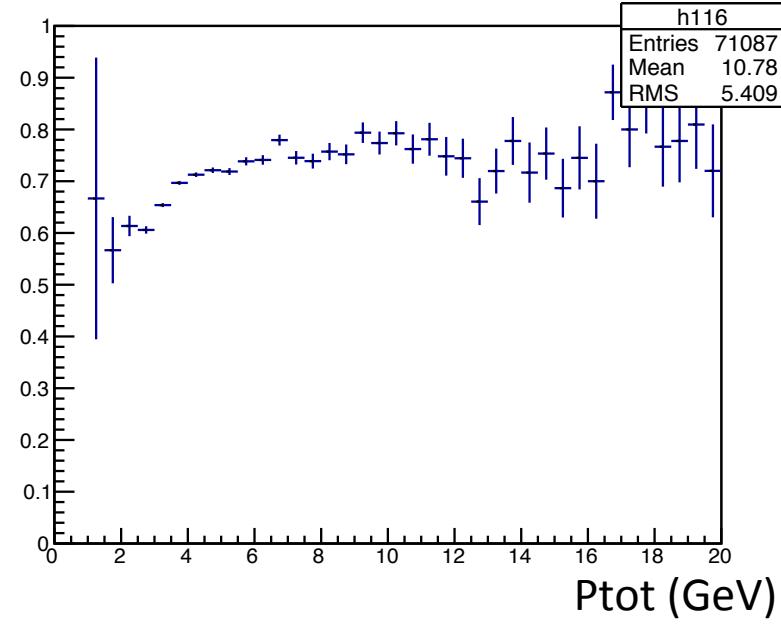


ERT Triggered "MB" events, lastgap=4

North Charge-0, MUID1D Trig-Eff

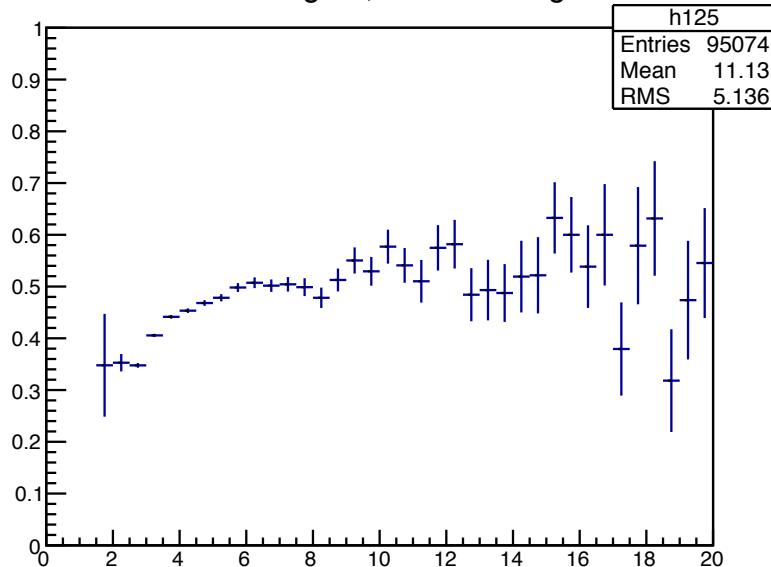


North Charge-1, MUID1D Trig-Eff

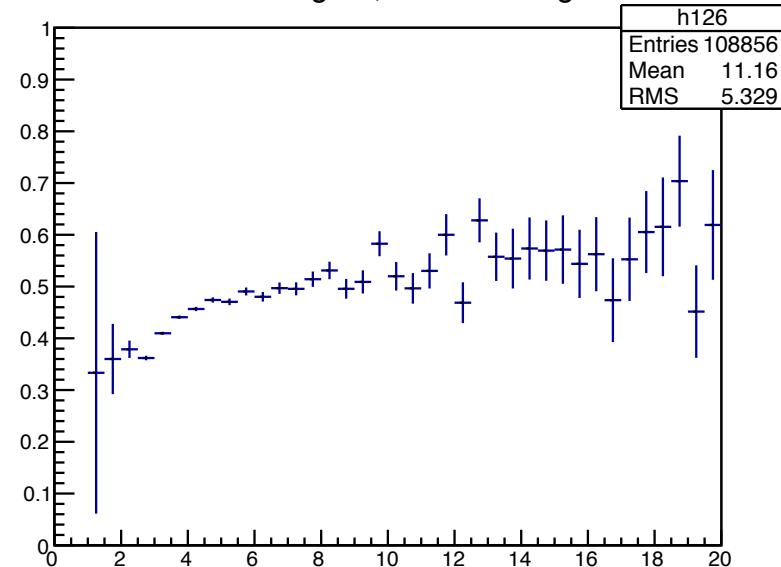


Ptot (GeV)

South Charge-0, MUID1D Trig-Eff

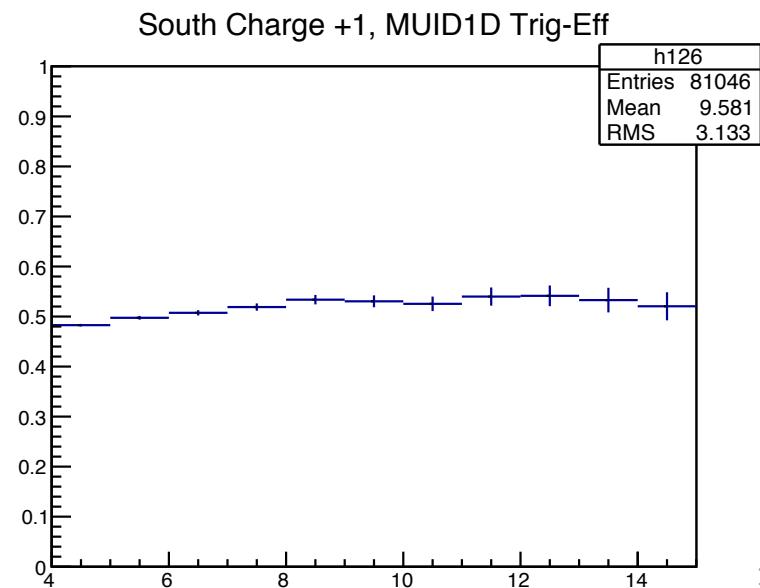
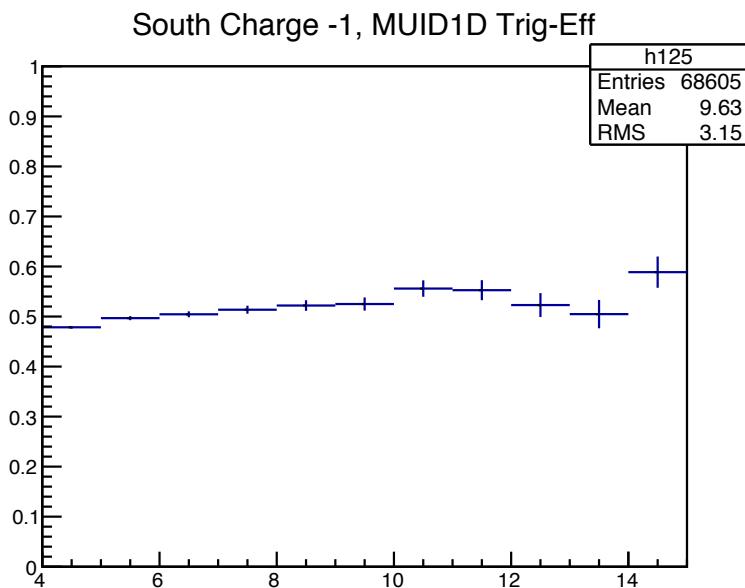
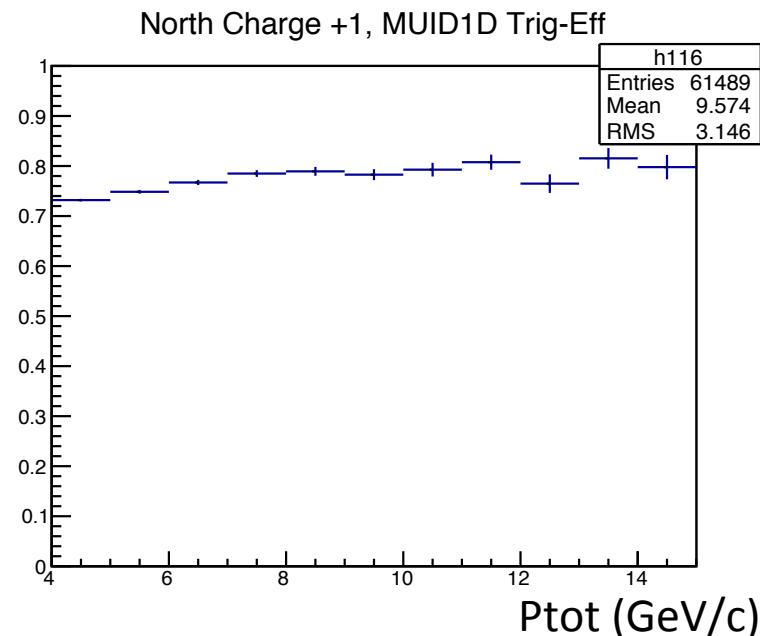
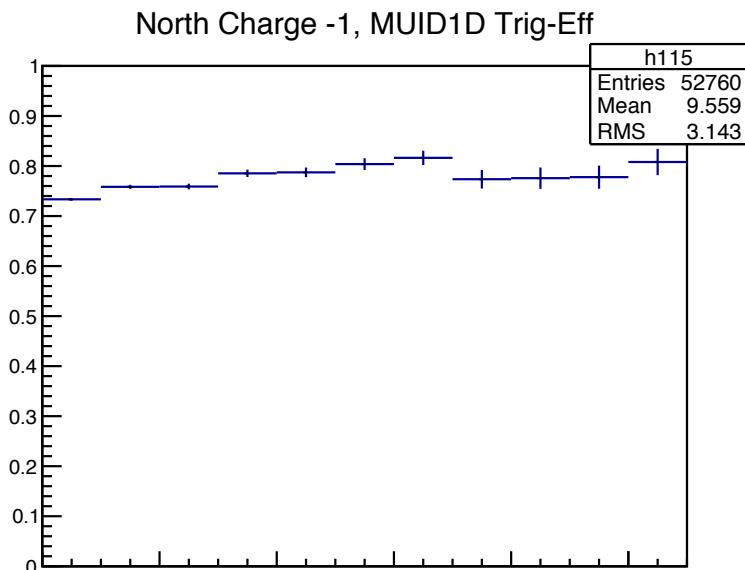


South Charge-1, MUID1D Trig-Eff



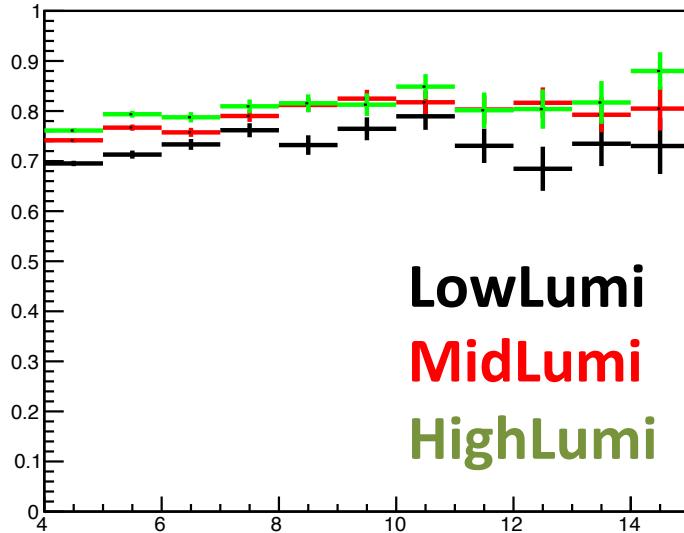
MPC Triggered "MB" events, if good mouns: lastgap=3 or 4

MUID1D Trigger Efficiency Ptot>4 GeV/c

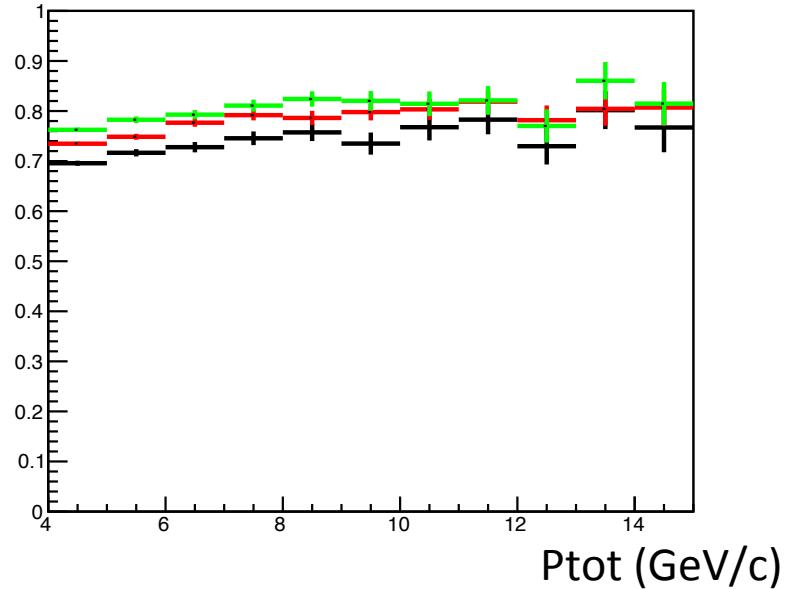


MUID1D Trigger Efficiency vs Ptot in Different Luminosity Run Groups ($P_{tot} > 4 \text{ GeV}/c$)

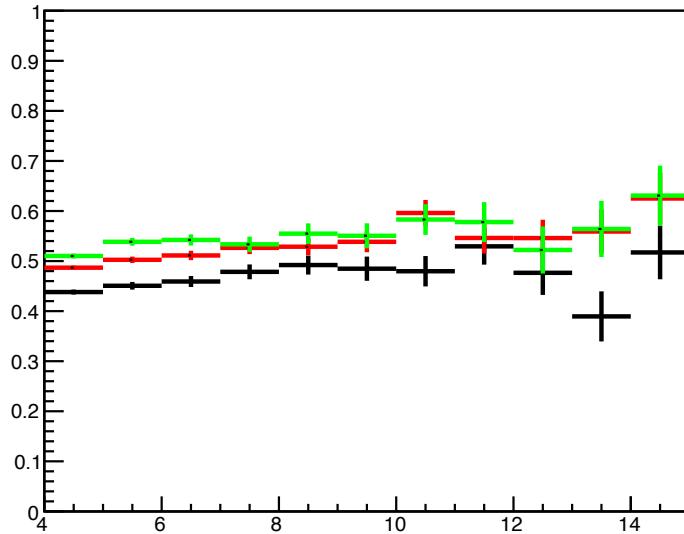
North Charge -1, MUID1D Trig-Eff



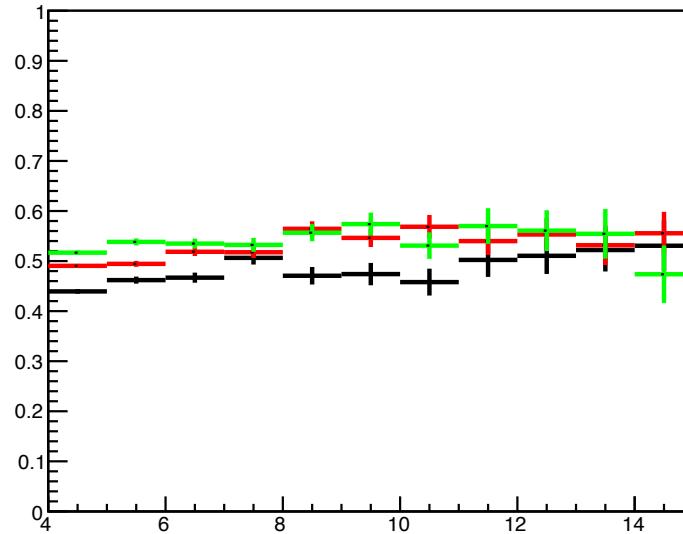
North Charge +1, MUID1D Trig-Eff



South Charge -1, MUID1D Trig-Eff



South Charge +1, MUID1D Trig-Eff



Observations on MUID1D Trigger Efficiency

MUID1D trigger efficiencies were only ~50% (South-Arm, ~75% North-Arm), for particle momentum > 4 GeV/c with obvious momentum dependencies.

In addition, panel-by-panel dependency in MUID1D trigger efficiencies were also observed (Run12pp200), make it rather complicated in studying gap3/gap4 ratios to use MUID1D triggered events as the first step.

Conclusion: although with limited statistics, we decided to use ERT triggered events to mimic Min-Bias events while studying gap3/gap4 event ratios and hadron/muon yield ratios.

Part-III Run12pp510: MUID Detector Efficiency Studies, Comparison of Data-Driven Method and HV-Method

- **A new solution** combining two earlier fits, and using Run15pp200 low-luminosity data.
- Run12pp510 results and two methods comparison.
- Run-by-run tube-by-tube efficiency files, data-method and HV-method produced
- **Luminosity-weighted average-tube-efficiency files, for all-lumi, low-lumi, mid-lumi, high-lumi run groups.**
- Summary plots of comparisons.
- **Uncertainties: two methods agree to $\pm 4\%$ level**

More details on the new mix2015 solution can be found in Run15pp200 analysis report.

Run12pp510 MUID_EFF Results and Conclusions

- Traditional Data-Driven method. MUID_EFF run-by-run, tube-by-tube files were generated.
- HV-method was also used to produced MUID_EFF files, used HV-current readings to calculate effective tube-voltage, referenced to efficiencies in cosmic-ray scan (fit2014).
- **Two-methods are compared. Differences resolved, a solution provided (mix2015).**
- Agreements between Data-Driven and HV-method typically to within $\pm 4\%$ level.
- **Run-by-run, tube-by-tube MUID_EFF files are produced**
- **Luminosity-weighted average-tube-efficiency files, for all-lumi, low-lumi, mid-lumi, high-lumi run groups. Under: Luminosity_Weighted_Average/... i.e.**
muid_tube_eff_south_Run12pp510_alllumi.txt
HVmuid_tube_eff_south_Run12pp510_alllumi.txt

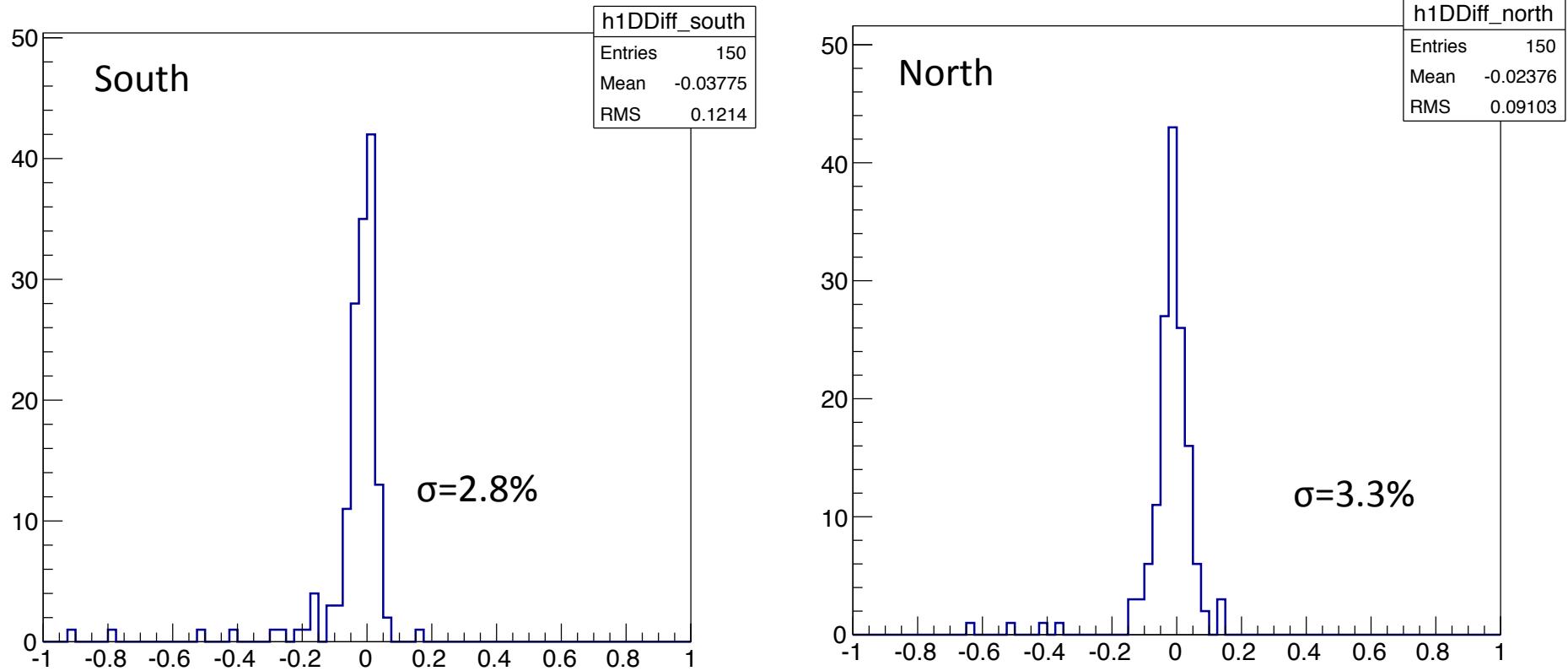
Conclusions on MUID_EFF Run12pp510: we've shown that the HV_method is reasonably consistent with traditional data_driven method (to $\pm 4\%$ level). Still, HV_method is NOT considered as a proven independent method to obtain MUID_EFF and cross section, while data_driven method has been used in all previous analysis. **Run12pp510 analysis should use the traditional data_driven method to obtain MUID_EFF, to preserve self-consistency. HV-method as "reasonable crosscheck".**

Summary slides followed by many detailed slides.

Summary Run12pp510 MUID_EFF:

Luminosity Averaged MUID_EFF for each hv-channel

Difference = (Data-Driven) – (HV Method)

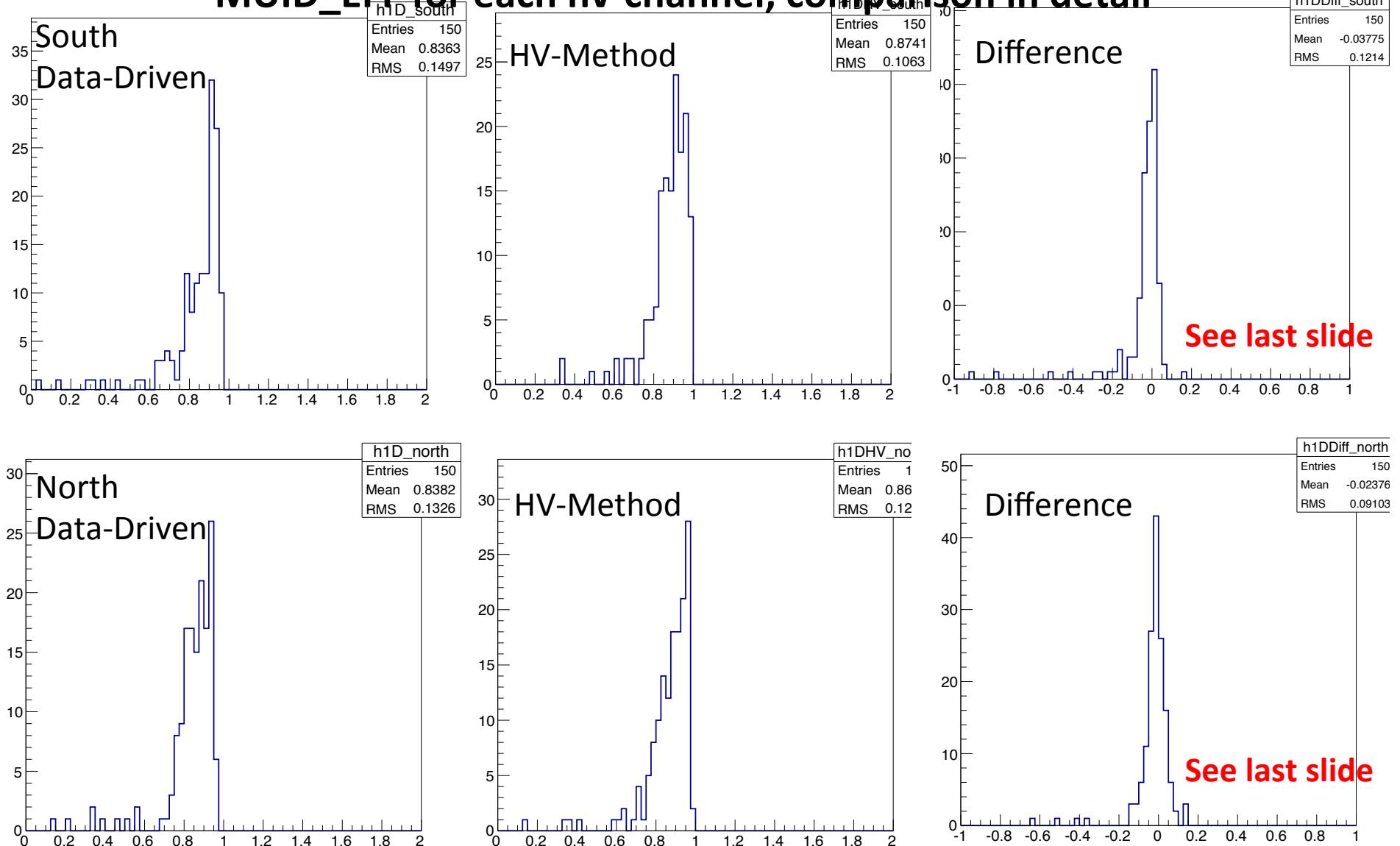


Luminosity-weighted average efficiency, one entry per hv-channel

Central value of differences: ~1%. Spread (FWHM): ~8%

Run12pp510: two methods agree to $\pm 4\%$ level.
 (Different luminosity run groups give the same results).

A Brief Summary Run12pp510: Luminosity Averaged MUID_EFF for each hv-channel, comparison in detail



Luminosity-weighted average efficiency, one entry per hv-channel

Observations, Further Works and Suggested Improvements

- MUID number of dead-tubes increased from year to year. (**109 ch in run2012pp510, 116 ch. In run15pp200, while earlier versions only listed 88 ch**)
- Degrading and instability of MUID-efficiency performance year-to-year in some channels were obvious.
- Cosmic ray HV scans are needed to obtain efficiency baseline, and check reproducibility.
- Low-collision rate data is needed to confirm MUID_EFF during production runs.

Although HV-method is not a completely independent crosscheck, it can serve as a reasonable confirmation of rate-dependent efficiency changes.

- The same solution for p+p might not directly work for p+A collision, due to higher luminosities. Need a careful check.
- Long cosmic ray runs are always needed, to check the baseline efficiency performance of detectors, and to obtain baseline dark-currents.
- **Whenever possible, should also take low-luminosity collision runs, for a direct check of efficiencies, and compared to cosmic run efficiencies.**
- **Should repeat the cosmic ray HV scans.**

Part-III Cont. Detailed Information On

Run12pp510: MUID Detector Efficiency Studies, Comparison of Data-Driven Method and HV-Method

Summary of the solution mix2015, developed while analyzing run15pp200 data.

Basic methods and procedures.

Panel-by-panel comparison.

Summary of the Solution: mix2015

Basic observations and assumptions:

- Run15pp200 luminosity is relatively low ($\sim 1\text{MHz}$), compared to Run13pp510 ($>3\text{ MHz}$).
- MUID currents, and MUID_EFF have a weak luminosity dependency, most channels don't need 4th power corrections.
- When lack of cosmic ray data, MUID_EFF in very low luminosity runs can be considered to be close to MUID_EFF in “real” cosmic ray runs.

Solution:

- **Keep fit2014 when it works well. If fit2014 agrees with fit2004 within $\pm 10\%$: mix2015=fit2014, (~120/150 channels in each arm, or ~80% of channels)**

In the remaining $\sim 20\%$ channels when fit2014 disagrees with fit2004 beyond $\pm 10\%$:

- **For $\sim 10\%$ of channels when eff>90%, take the old universal fit2004,
 $\text{Eff_mix2015}=\text{fit2004} = 0.96*(1.0-2.4e-6*Vs^2)$.**
- **For $\sim 10\%$ of channels, when eff<90%, take the form
 $\text{Eff_mix2015}=P0*(1.0-2.4e-6*Vs^2)$ where P0 should be anchored by cosmic runs, but we take the lowest luminosity run in Run15pp200, (run#422085, 175kHz bbc rate), due to the lack of good cosmic ray data in run15.**

MUID_EFF Data Driven Method

AnaNote1137

Run13pp510W2mu

Assumed MUID efficiencies are the same for tubes belong to the same hv_group.
Efficiency numbers are only used later in the simulation, in selected reference runs.

Not accounted for possible GL1 related inefficiencies at the trigger.

Standard method adopted since run5

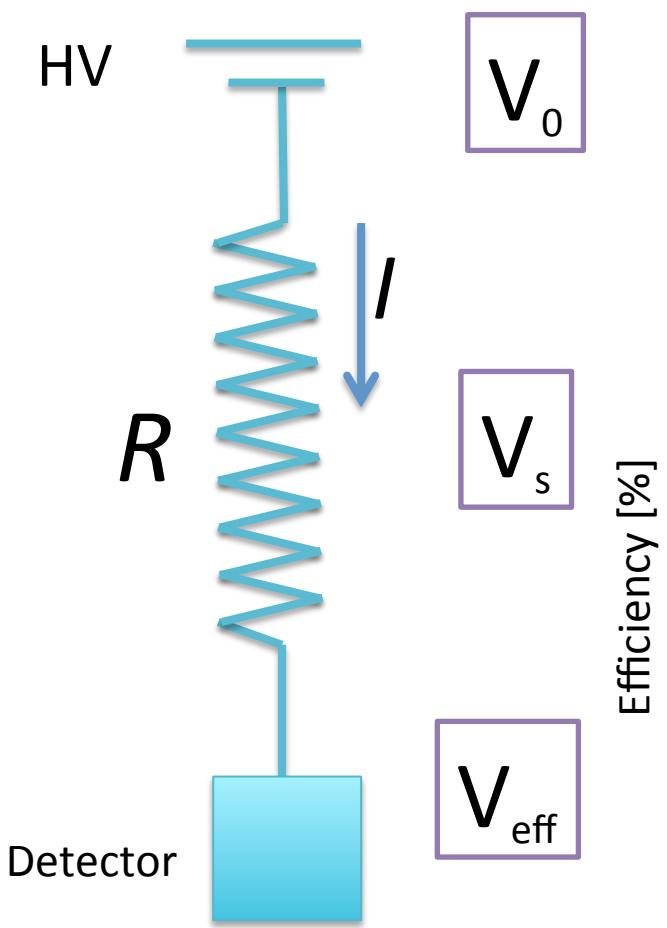
$$\text{Efficiency}_{\text{iplane}} = \frac{\text{hit in iplane}}{\text{MuTr tracks which require MuID road finder and trigger emulator}}$$

Not exactly hit-efficiency as defined, trigger roads involved.

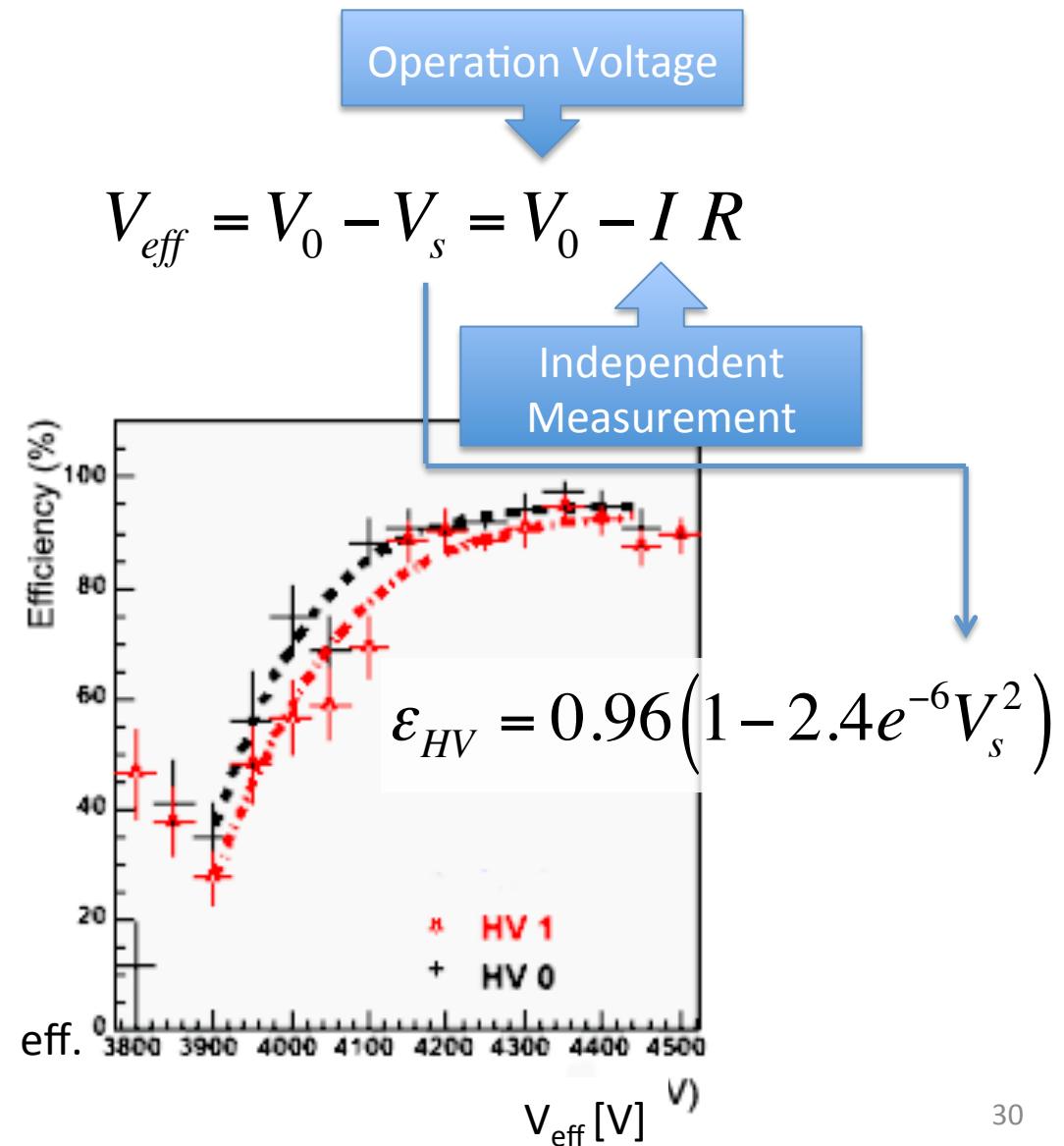
Run12pp510 run-by-run, panel-by-panel, tube-by-tube files under:

https://www.phenix.bnl.gov/phenix/WWW/publish/xjiang/Run12/Run12pp510/Run12pp510_MUID_EFF/

HV method



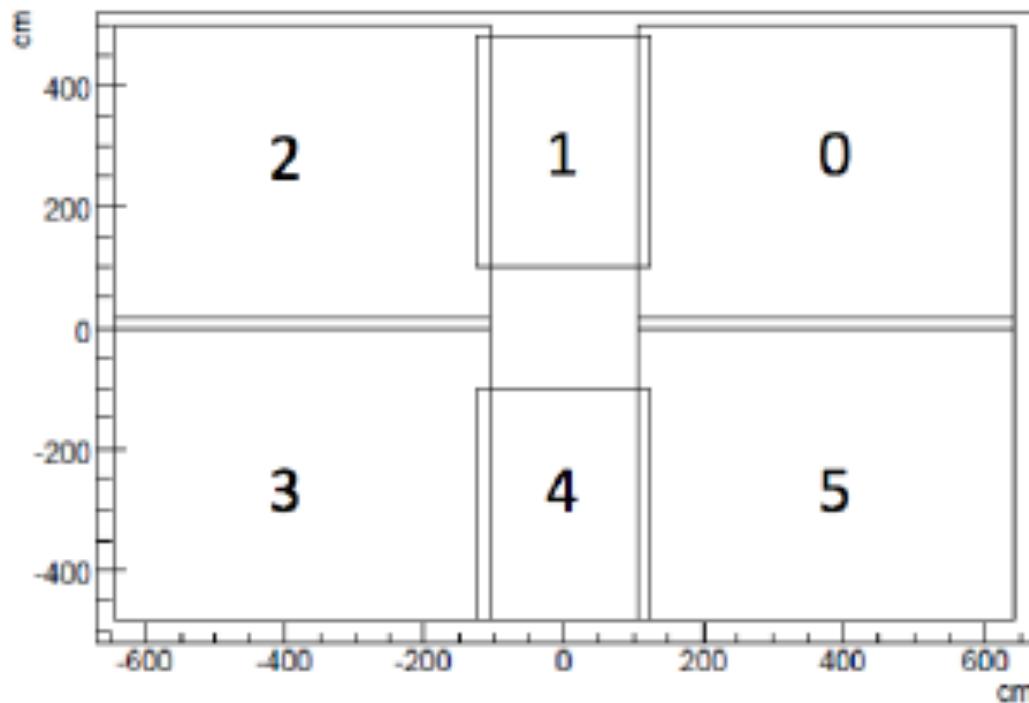
Effective voltage on MUID-tubes are lower due to dark current caused voltage drops.
Take dark currents in cosmic-runs as BaselineCurrent



From Itaru, July 2014 MUID HV-Scan

Cosmic ray, scan oper. Voltage, calc. eff.

MUID Geom



MUID Detector numbering Scheme

5 gaps: 0-4,

2 planes each gap: 0-1

6 panels each plane: 0-5

3 hv groups each panel
(except panel #1, #4)

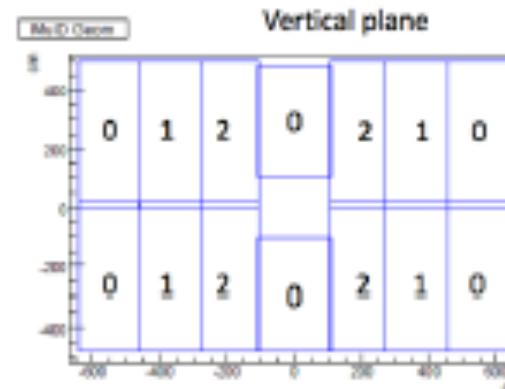
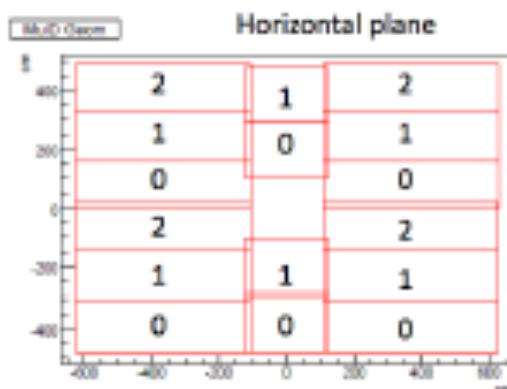


Figure 1.1: The top plot shows panel numbering scheme. Each plane has six panels. The bottom plots show the structure of hv groups for each horizontal and vertical plane.

AnaNote1137
Run13pp510W2mu

Using MuID HV Channel Current Reading to Calculate MuID Efficiency

following Itaru Nakagawa et al, 2014 studies.

Establishing the efficiency-baseline:

Cosmic rays HV scans (mid-2014) -> MUID efficiencies vs HV as the baseline

In Run12pp510 data:

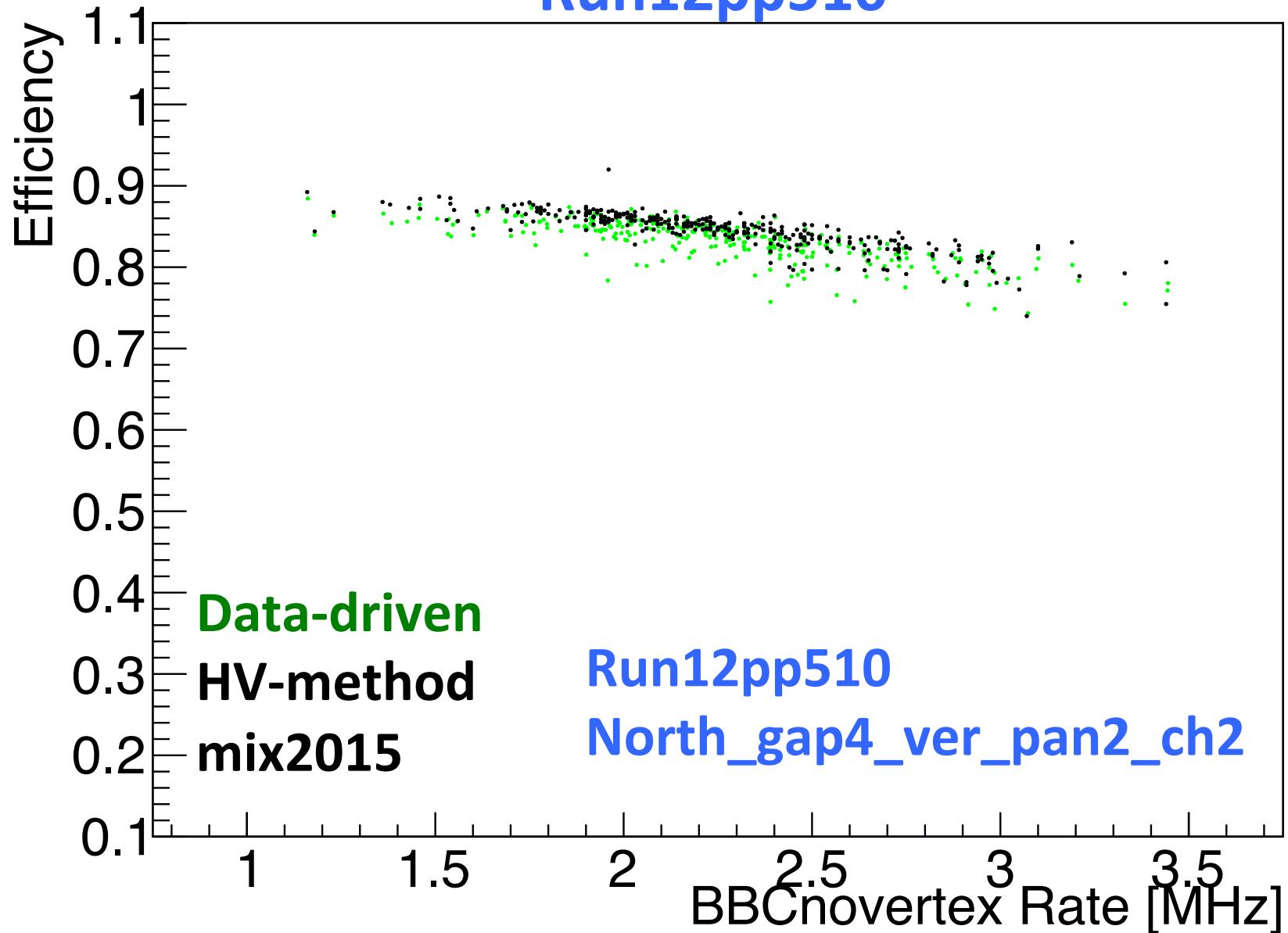
MuID HV current -> averaged dark current per live-tube -> effective HV on tube
-> check efficiency-baseline, obtain muid-tube-efficiency

The procedure of HV-method:

- Cosmic ray run obtain baseline dark current. Calculate number of dead tubes per HV channel.
- Read-in current per HV channel in data, calculate averaged dark-current per tube. Calculate effective voltage drops.
- Reference to cosmic-ray HV scan for the corresponding MUID HV-group efficiencies.
- Obtain tube-by-tube efficiencies.

Comparison Data-Drive vs HV-method

Run12pp510



Data-driven HV-method mix2015

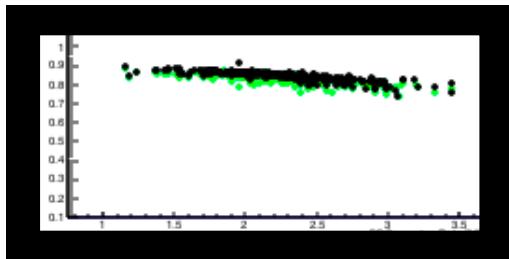
Run12pp510

North Arm

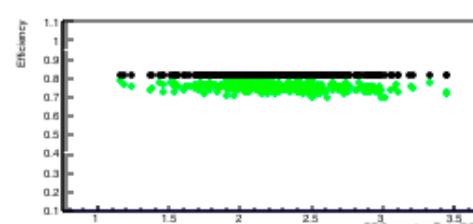
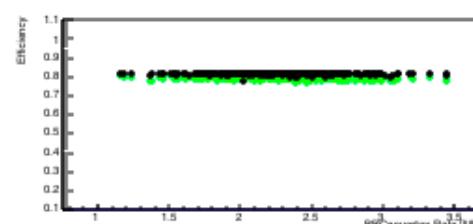
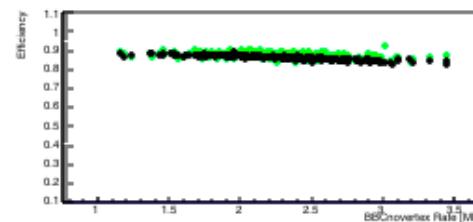
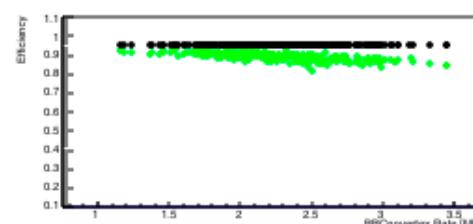
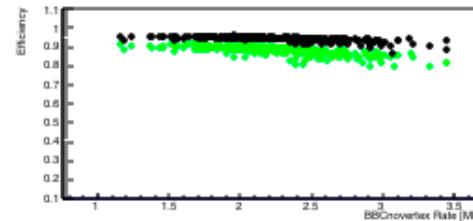
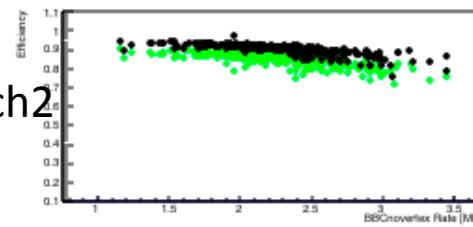
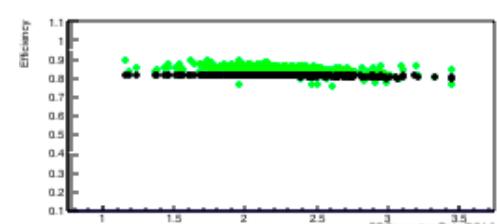
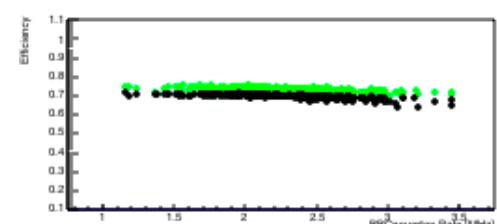
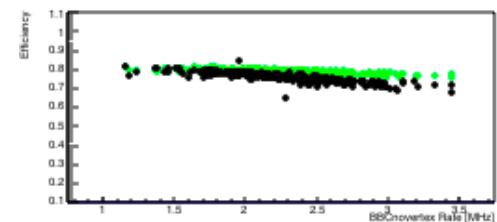
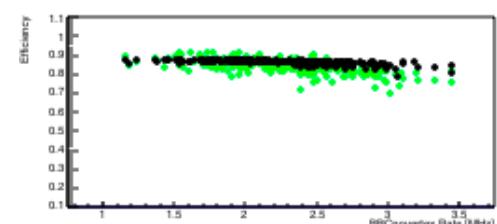
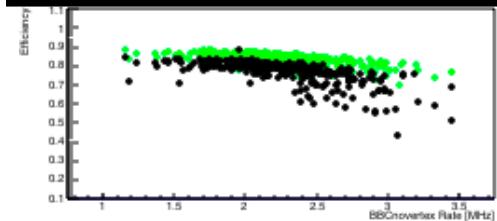
Gap 4 vertical

Run12pp510

- Data Driven
- HV method mix2015

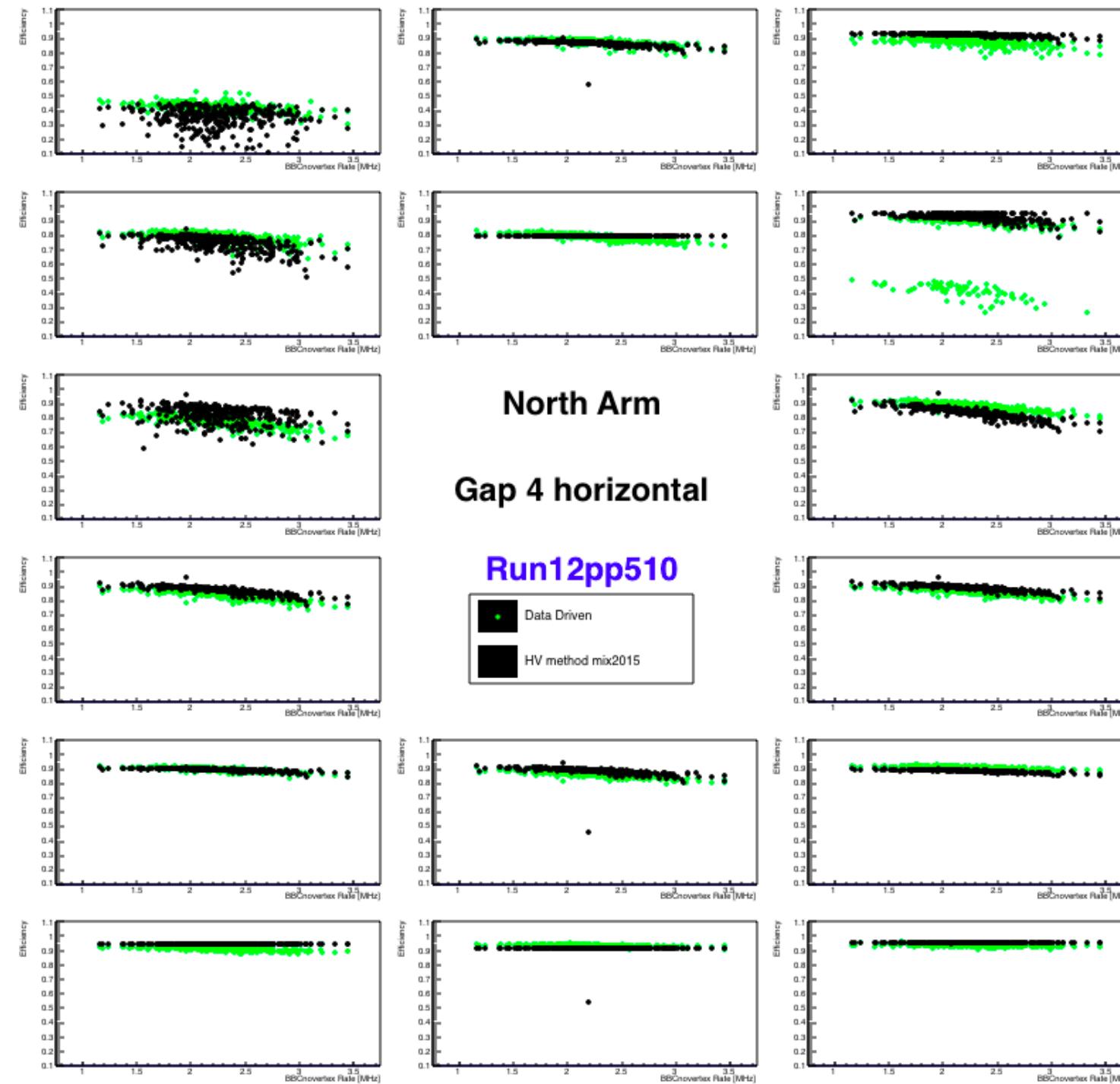


As shown in last side
North_gap4_ver_pan2_ch2



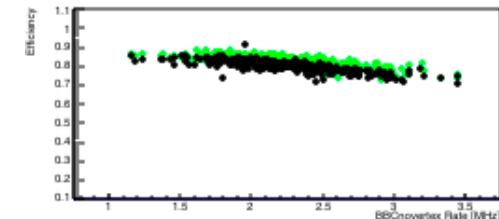
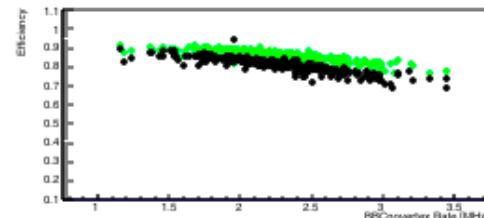
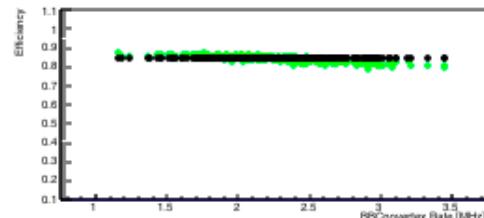
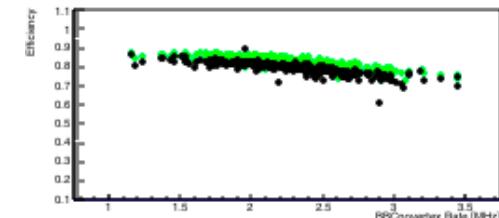
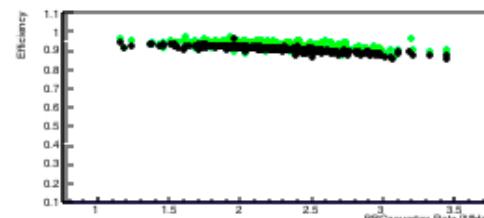
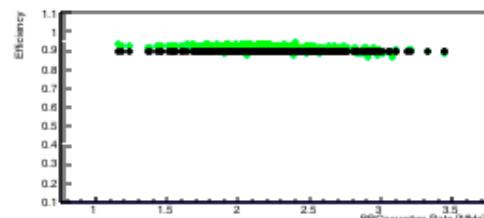
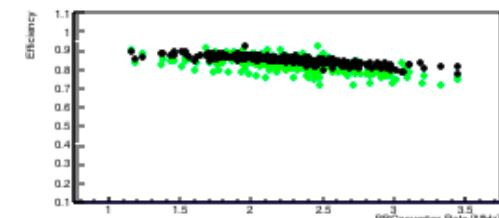
Data-driven HV-method mix2015

Run12pp510



Data-driven HV-method mix2015

Run12pp510

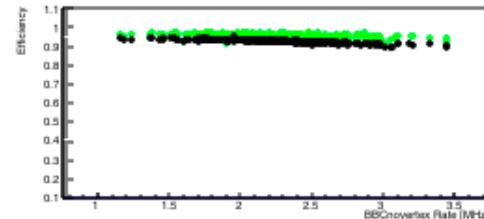
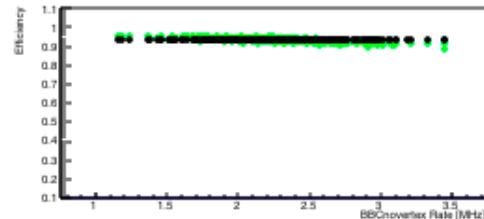
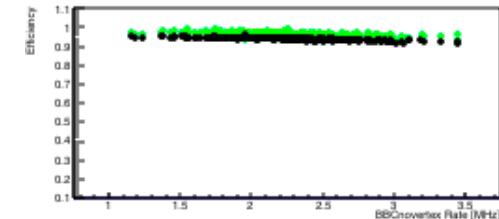
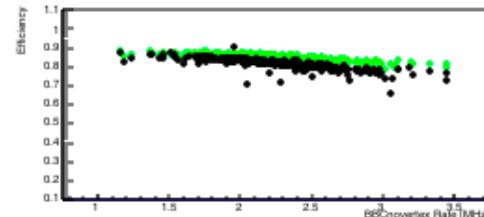
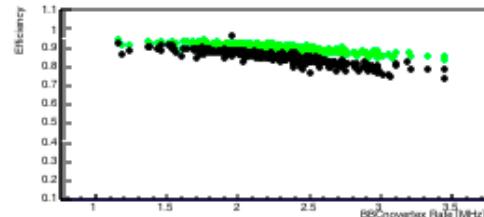
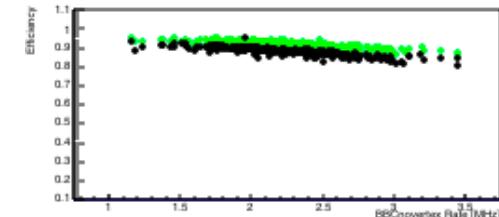
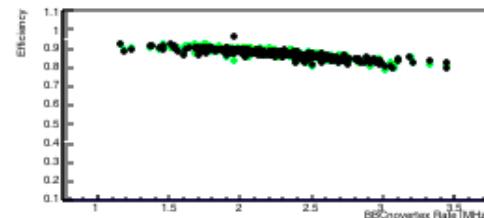
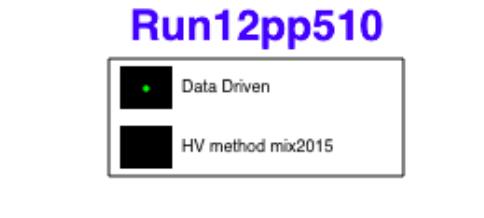
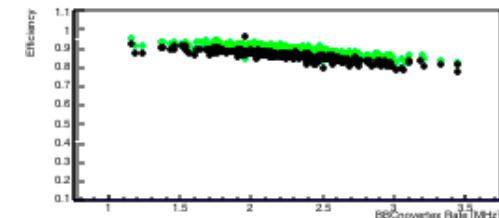


North Arm

Gap 0 horizontal

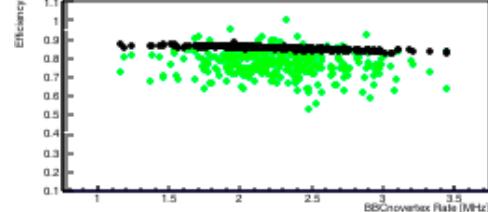
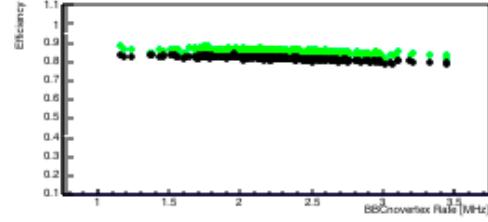
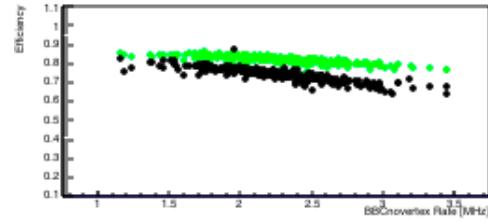
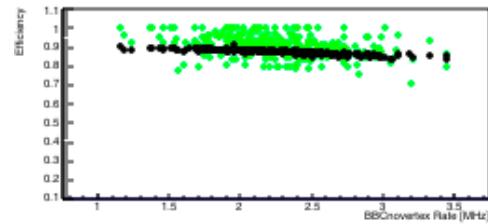
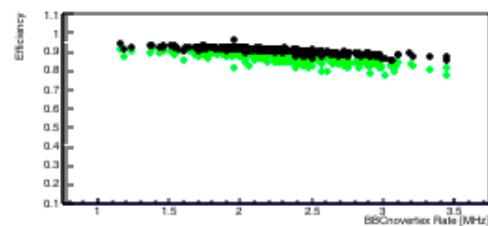
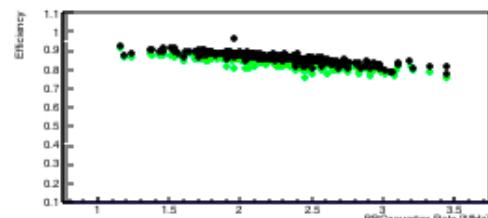
Run12pp510

- Data Driven
- HV method mix2015



Data-driven HV-method mix2015

Run12pp510

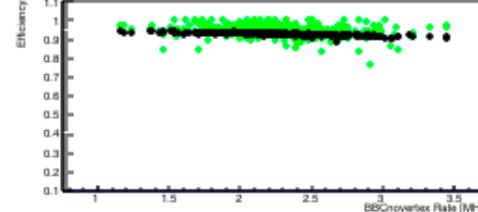
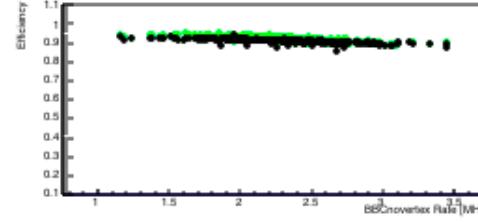
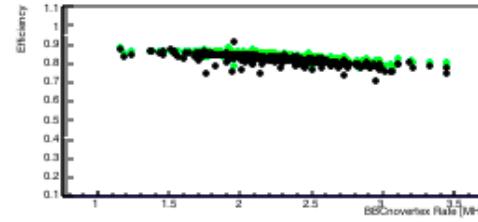
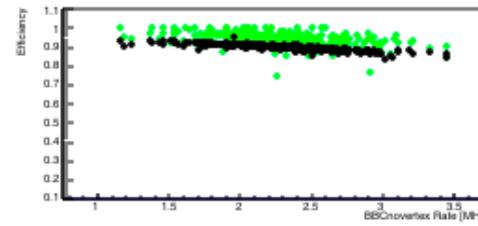
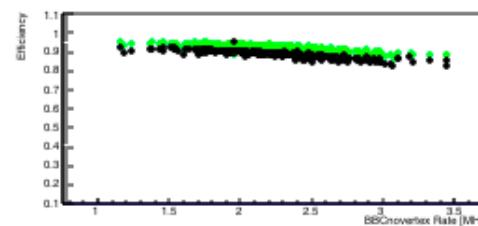
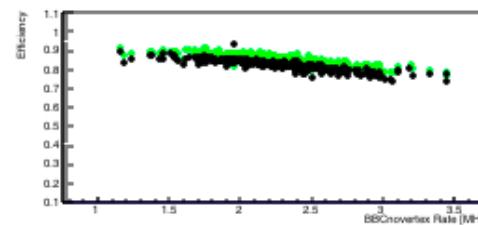


North Arm

Gap 0 vertical

Run12pp510

■ Data Driven
■ HV method mix2015



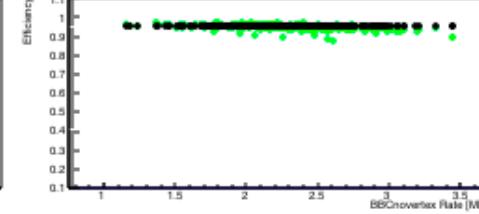
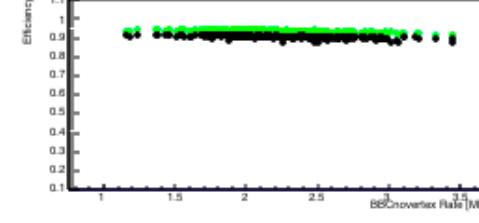
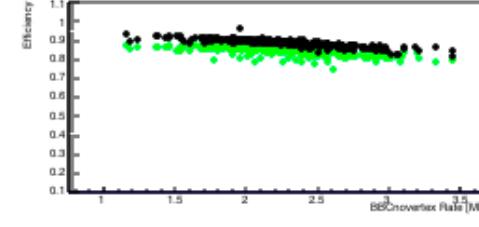
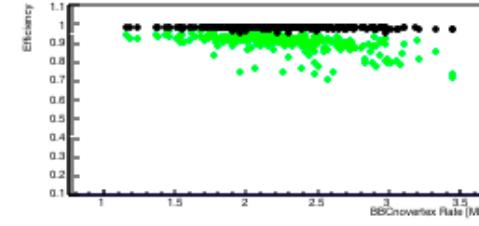
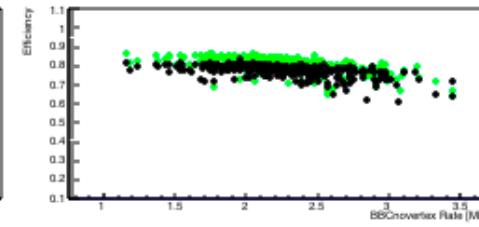
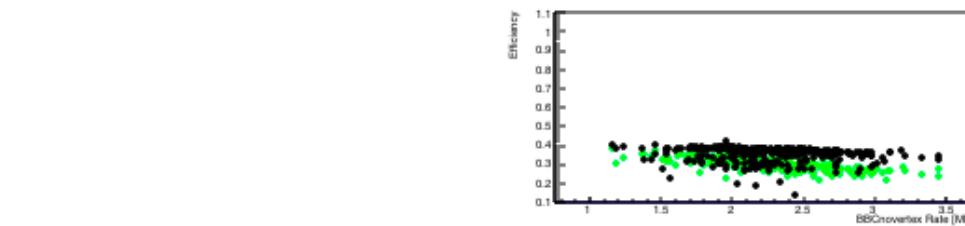
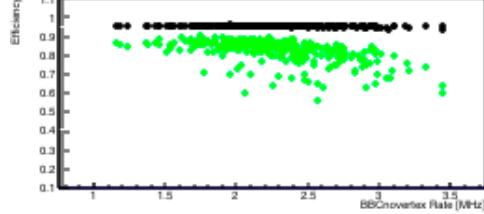
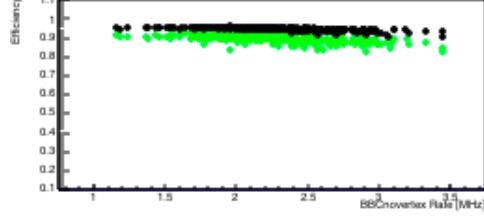
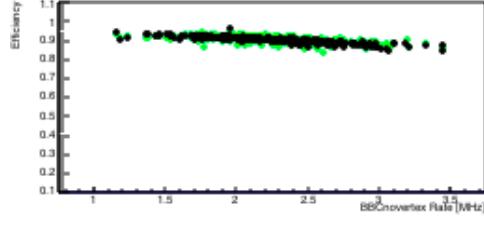
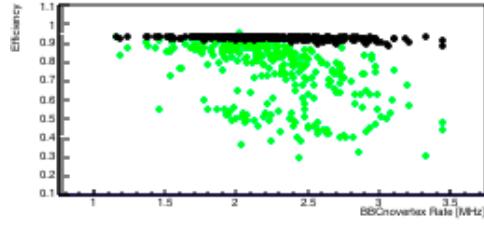
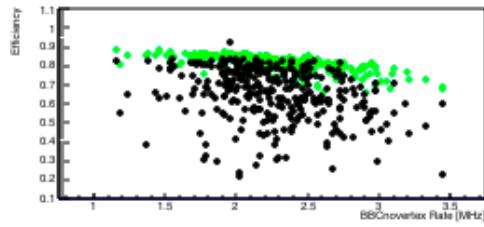
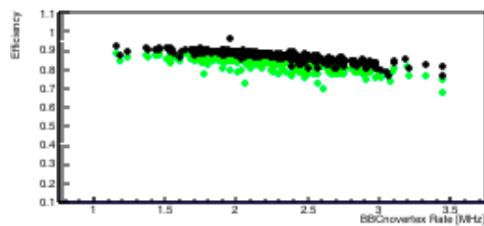
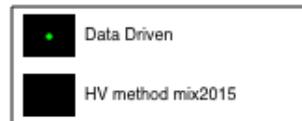
Data-driven HV-method mix2015

Run12pp510

South Arm

Gap 4 vertical

Run12pp510

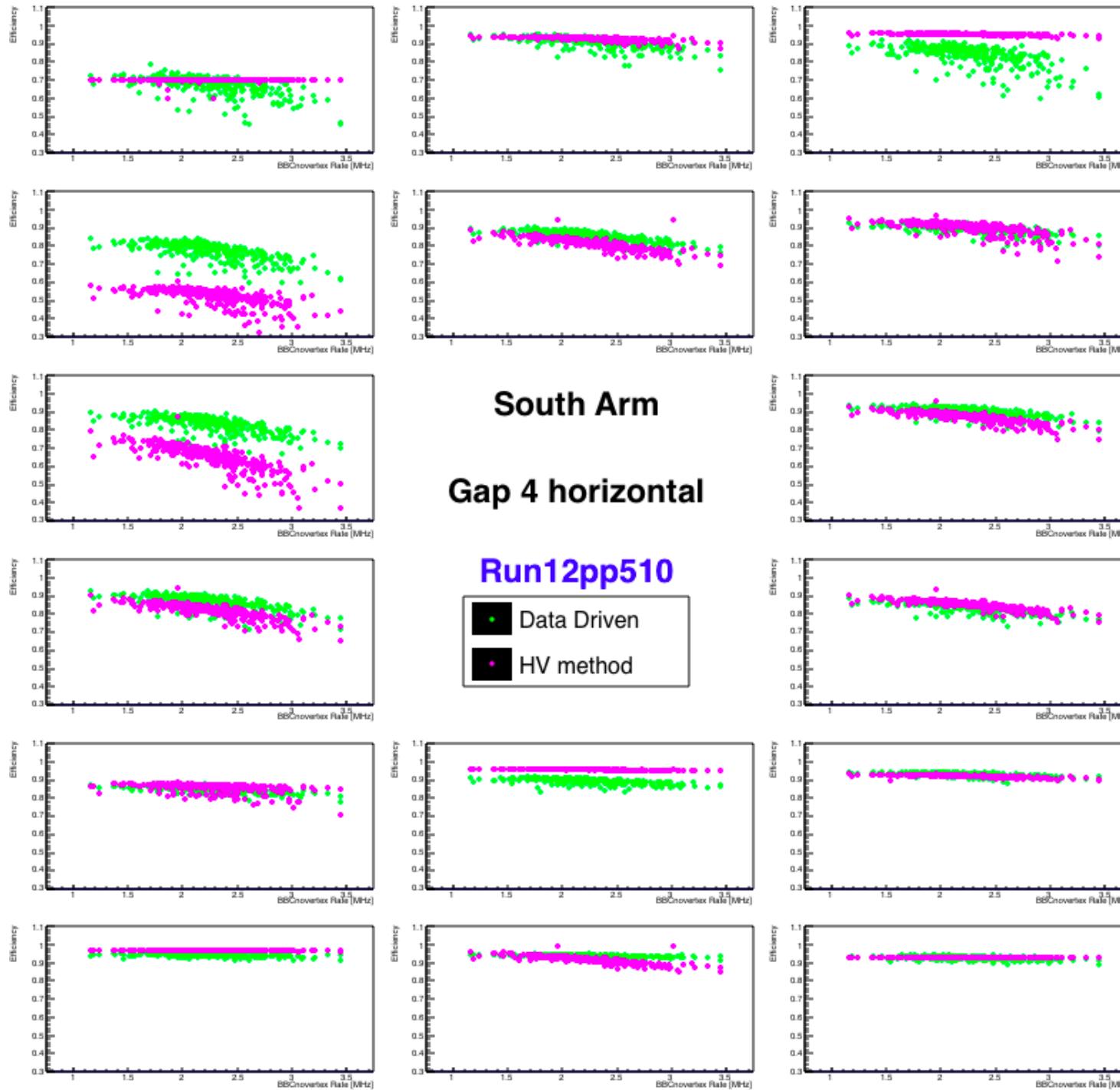


Run12pp510 MUID_EFF Two Methods Selected Panel-by-Panel Comparison

BEFORE: use fit2014 and an old-dead-tube file.

AFTER: use mix2015 fit, and a new dead tube file

BEFORE



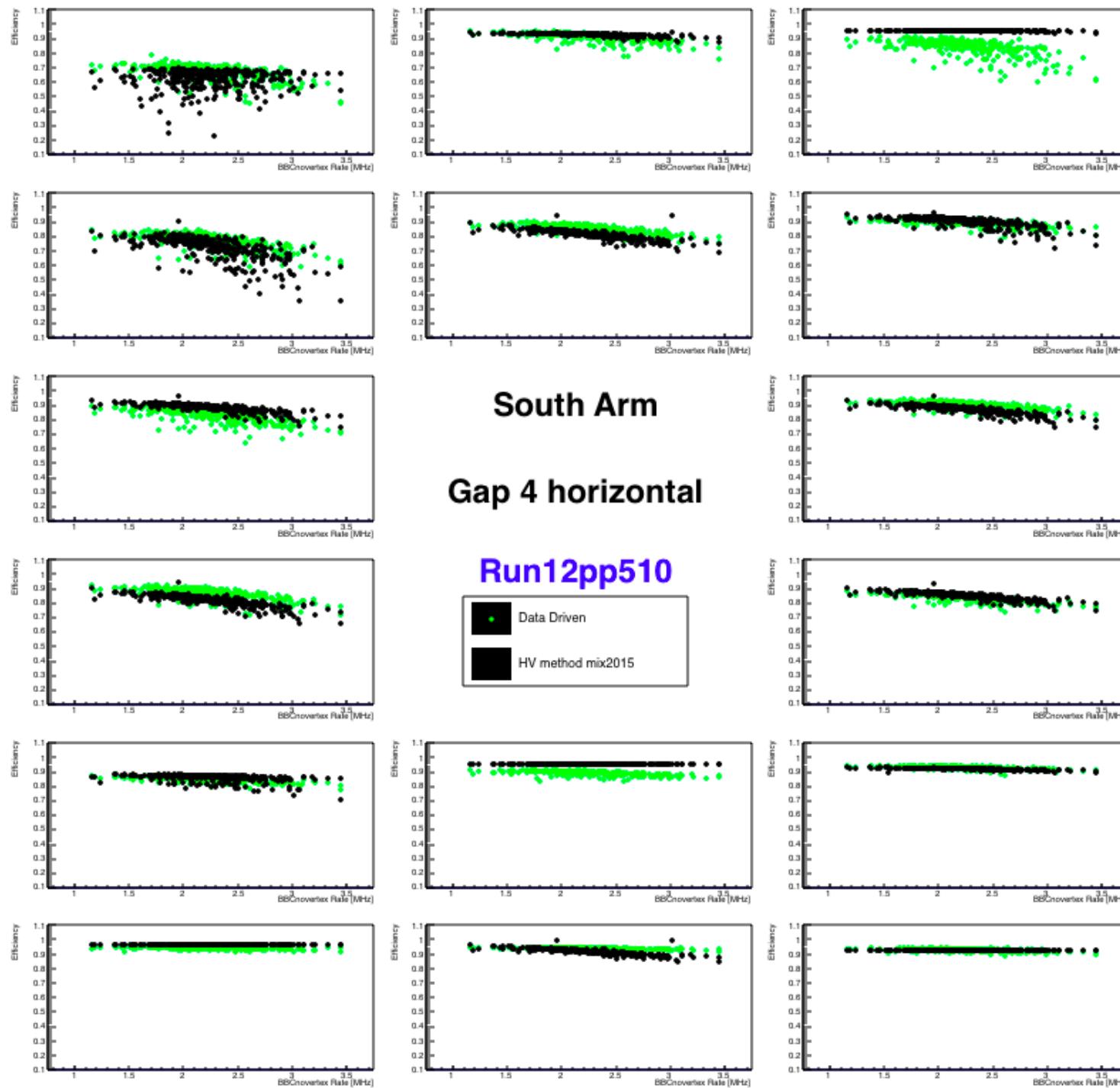
Typical
disagreements
**before using
mix2015
solution.**

**Data-driven
HV-method
fit2014**

AFTER

Data-driven
HV-method
mix2015

Run12pp510



BEFORE

Disagreement
were ~20%.

Issues resolved later.

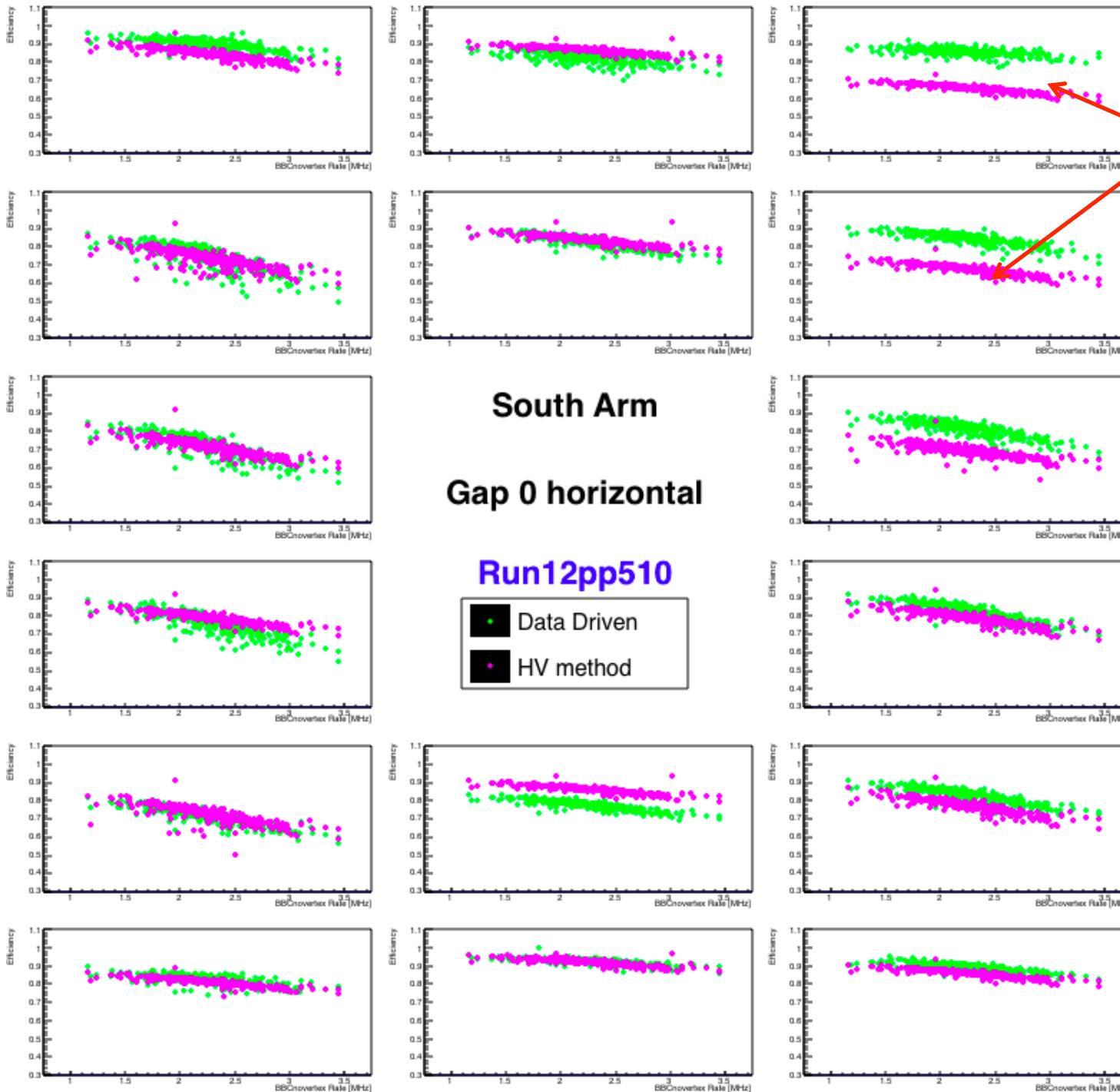
South Arm

Gap 0 horizontal

Run12pp510

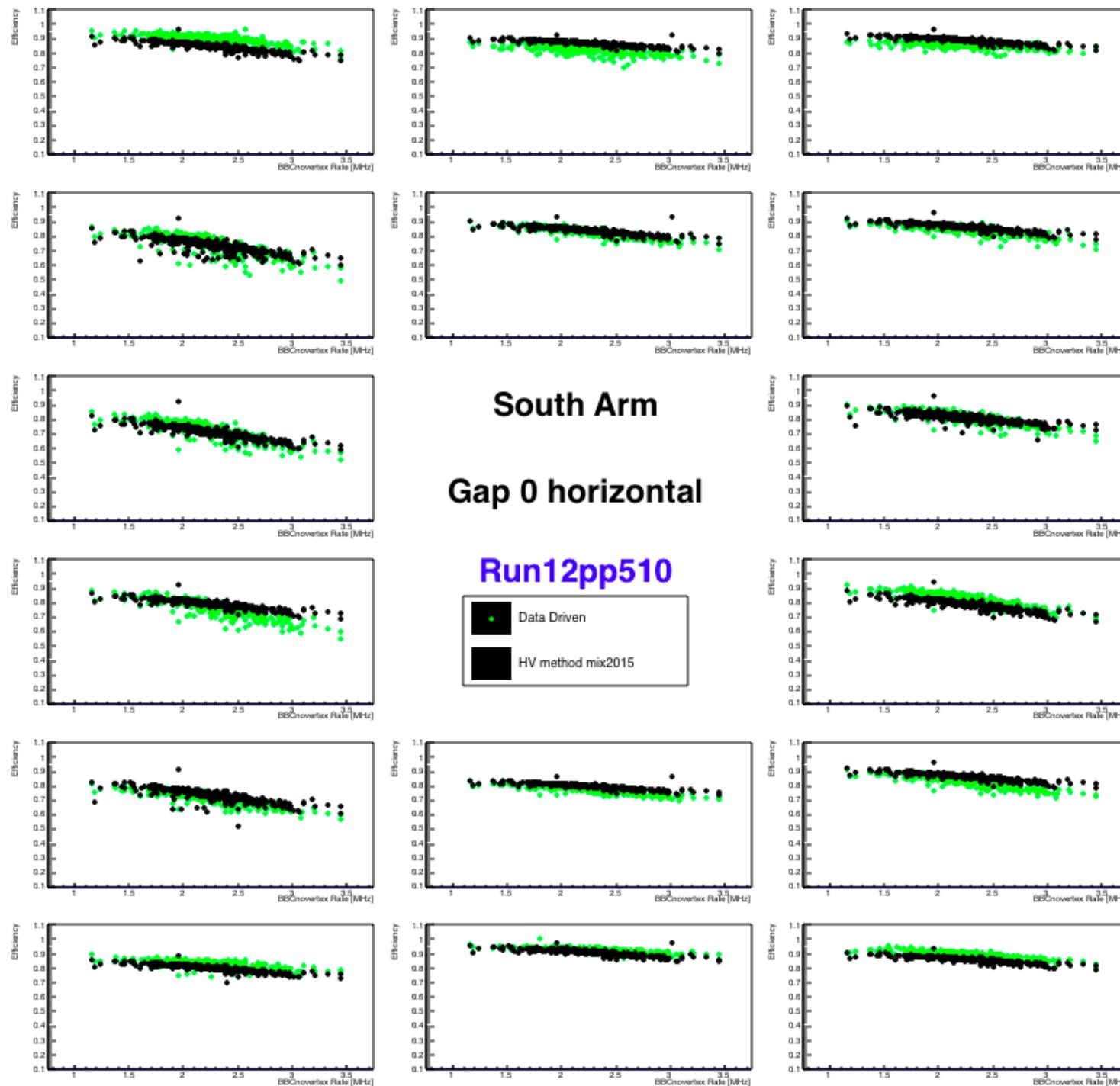
- Data Driven
- HV method

Data-driven
HV-method
fit2014



AFTER

Data-driven
HV-method
mix2015



**More details on the new solution
on MUID_EFF can be found in
Run15pp200 report.**

Part-IV Run12pp510: Run-by-Run Checks of MuTr-MUID Data Quality and GoodRunLists

More run selections based on MuTr detector performance, following procedures developed in Run9 and Run10 analysis

- MuTr detector level checks
- FlaggedRunList
- GoodRunLists

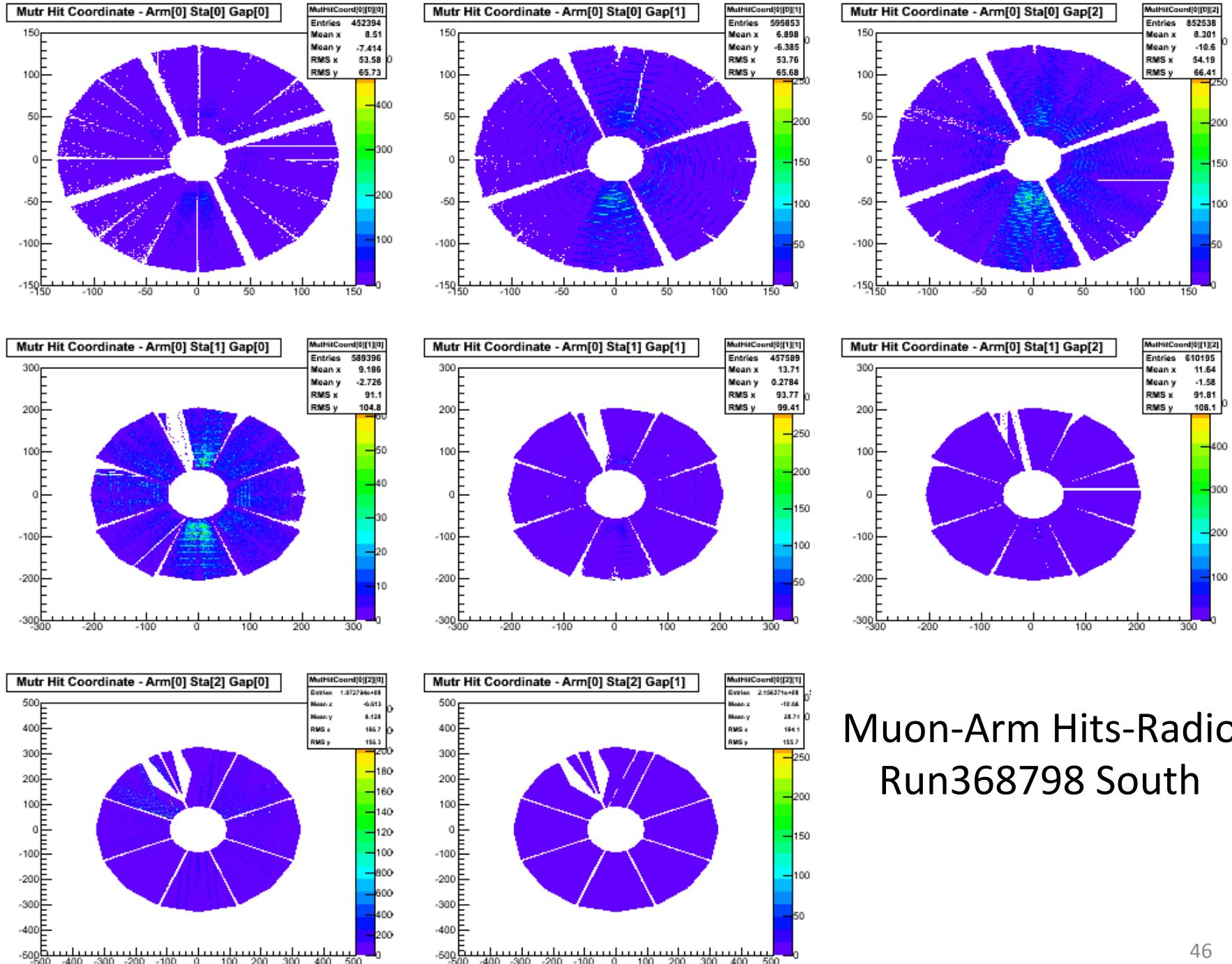
Run-by-run MuTr detector performance plots are generated, at:

https://www.phenix.bnl.gov/phenix/WWW/publish/xjiang/Run12/Run12pp510/Run12pp510_QA/run12pp510_qarequests/

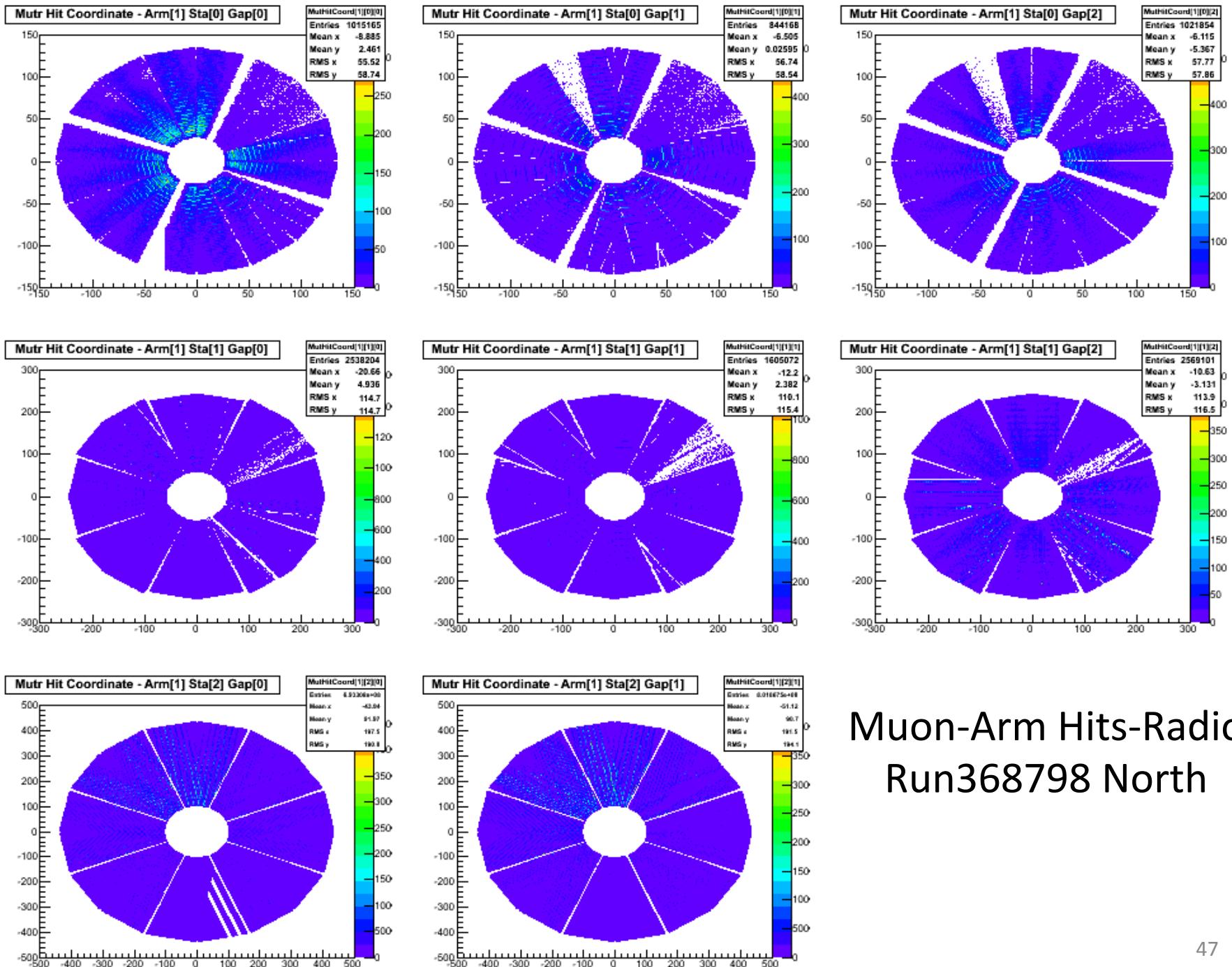
Before_flagged

After_flagged

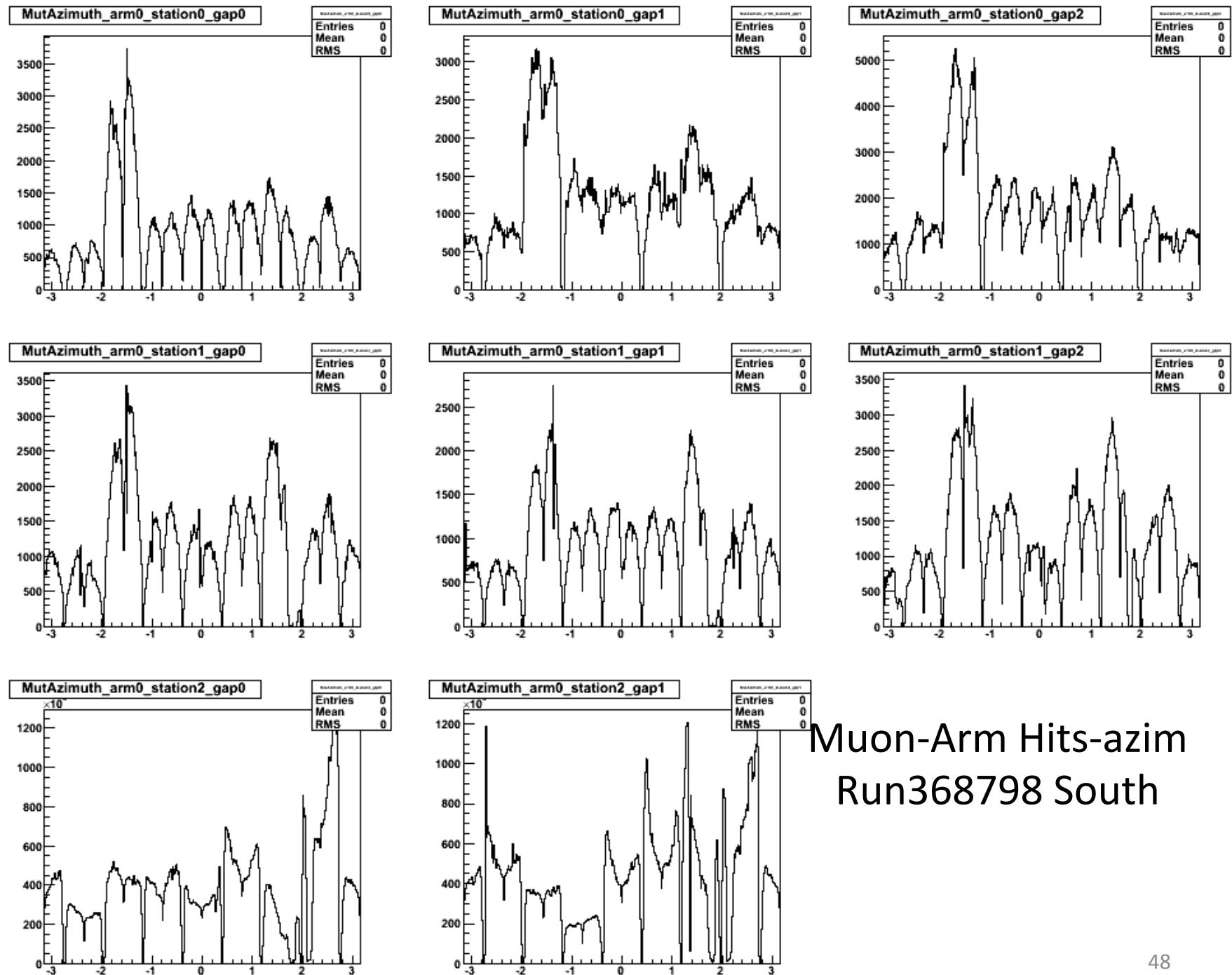
Typical MUTR Detector Plots...



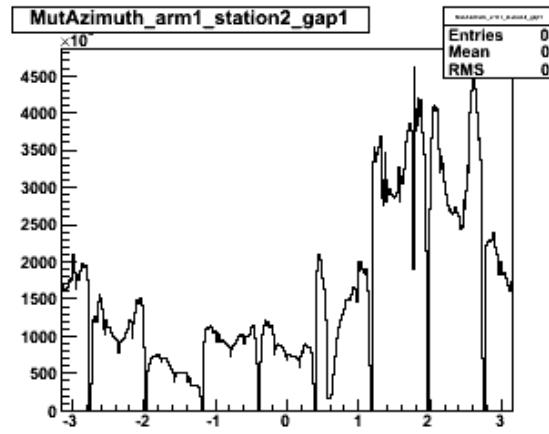
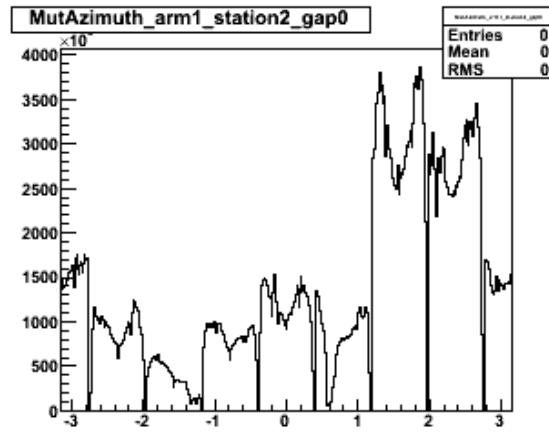
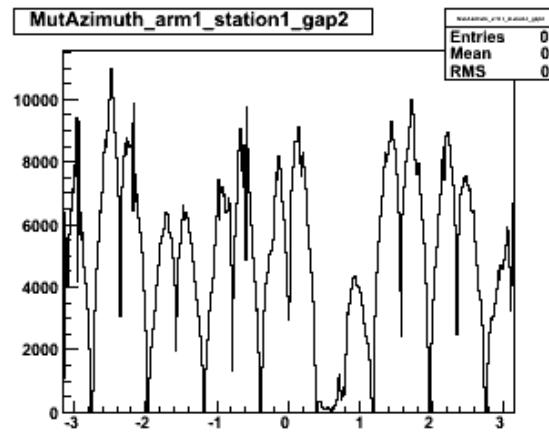
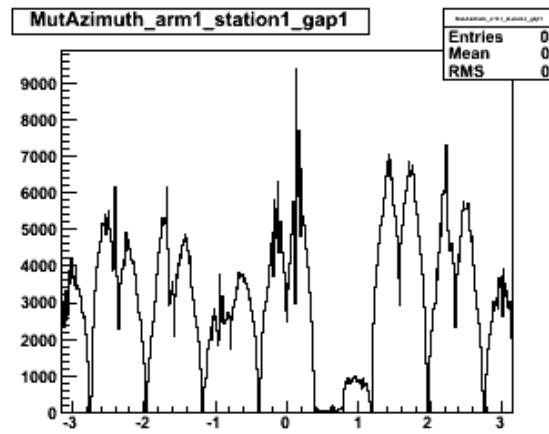
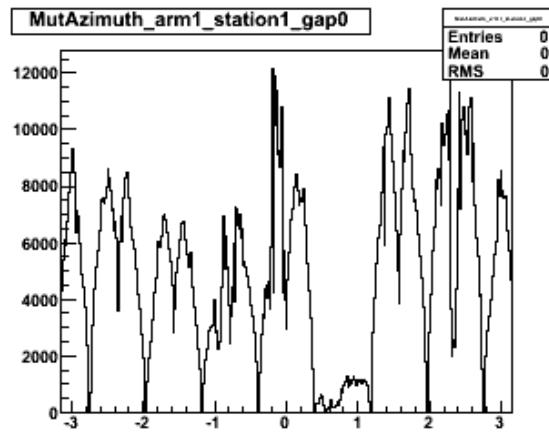
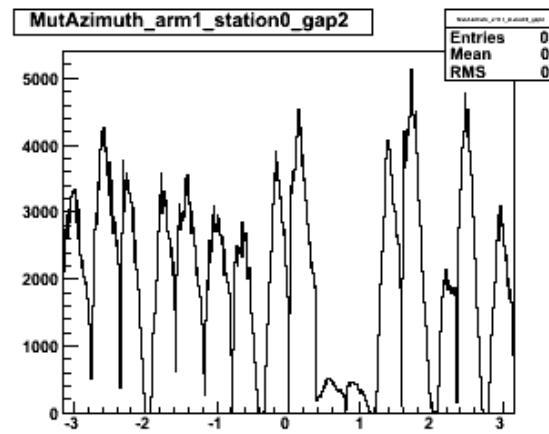
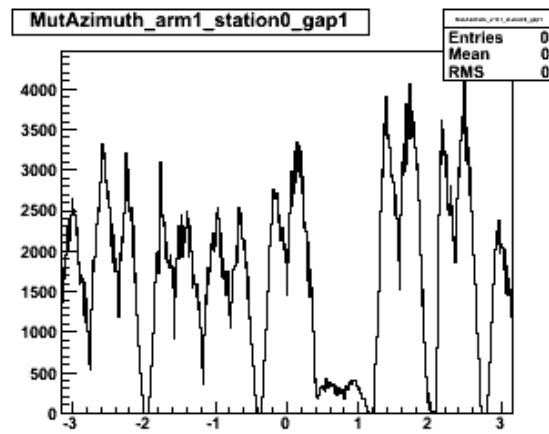
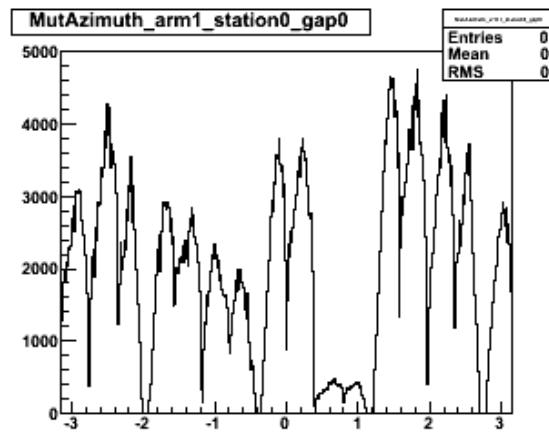
Muon-Arm Hits-Radio
Run368798 South



Muon-Arm Hits-Radio
Run368798 North



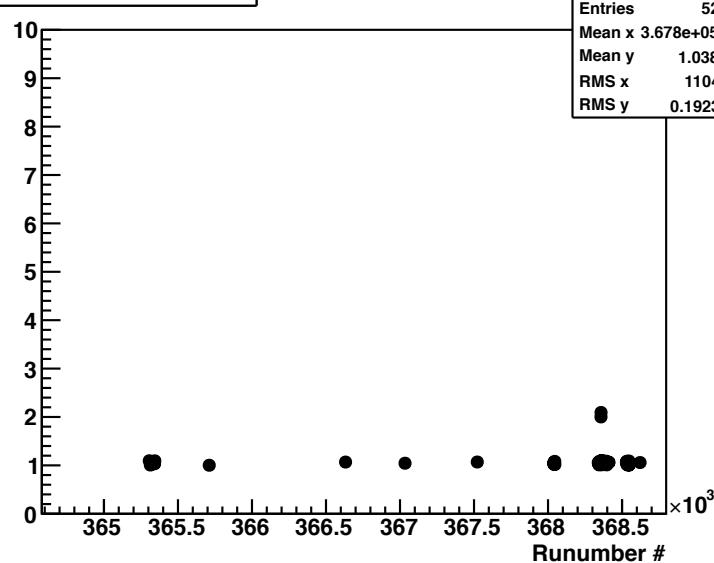
Muon-Arm Hits-azim
Run368798 South



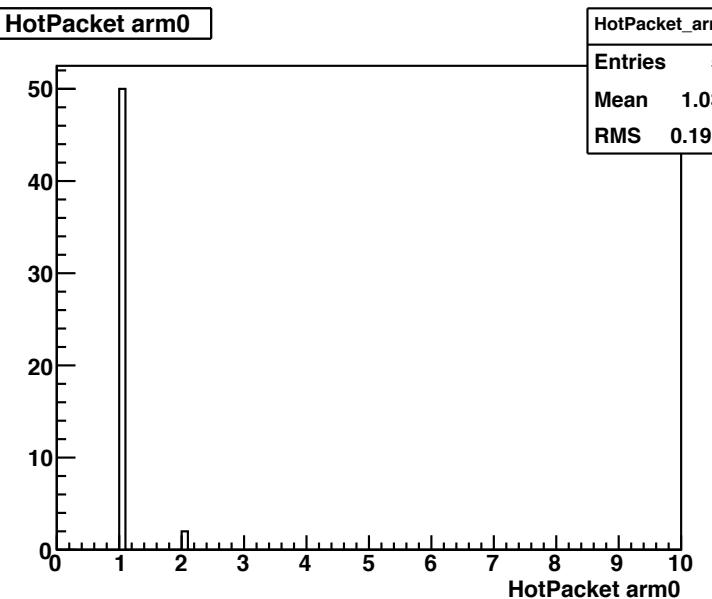
**Muon-Arm Hits-azim
Run368798 North**

South-Arm ReadOutError: Flag Hot/Dead Packet >=2

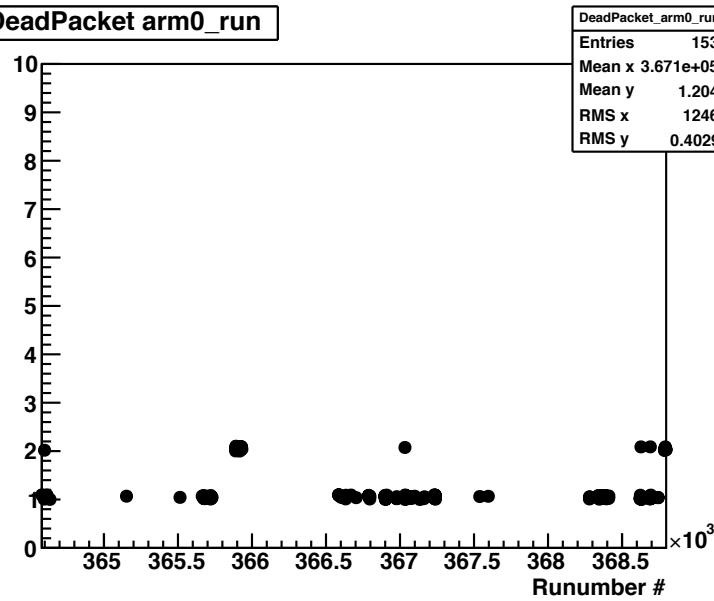
HotPacket arm0_run



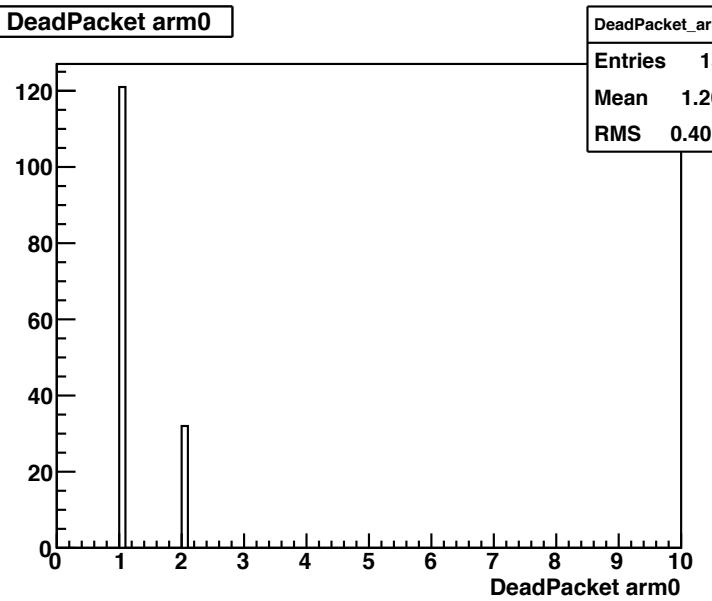
HotPacket arm0



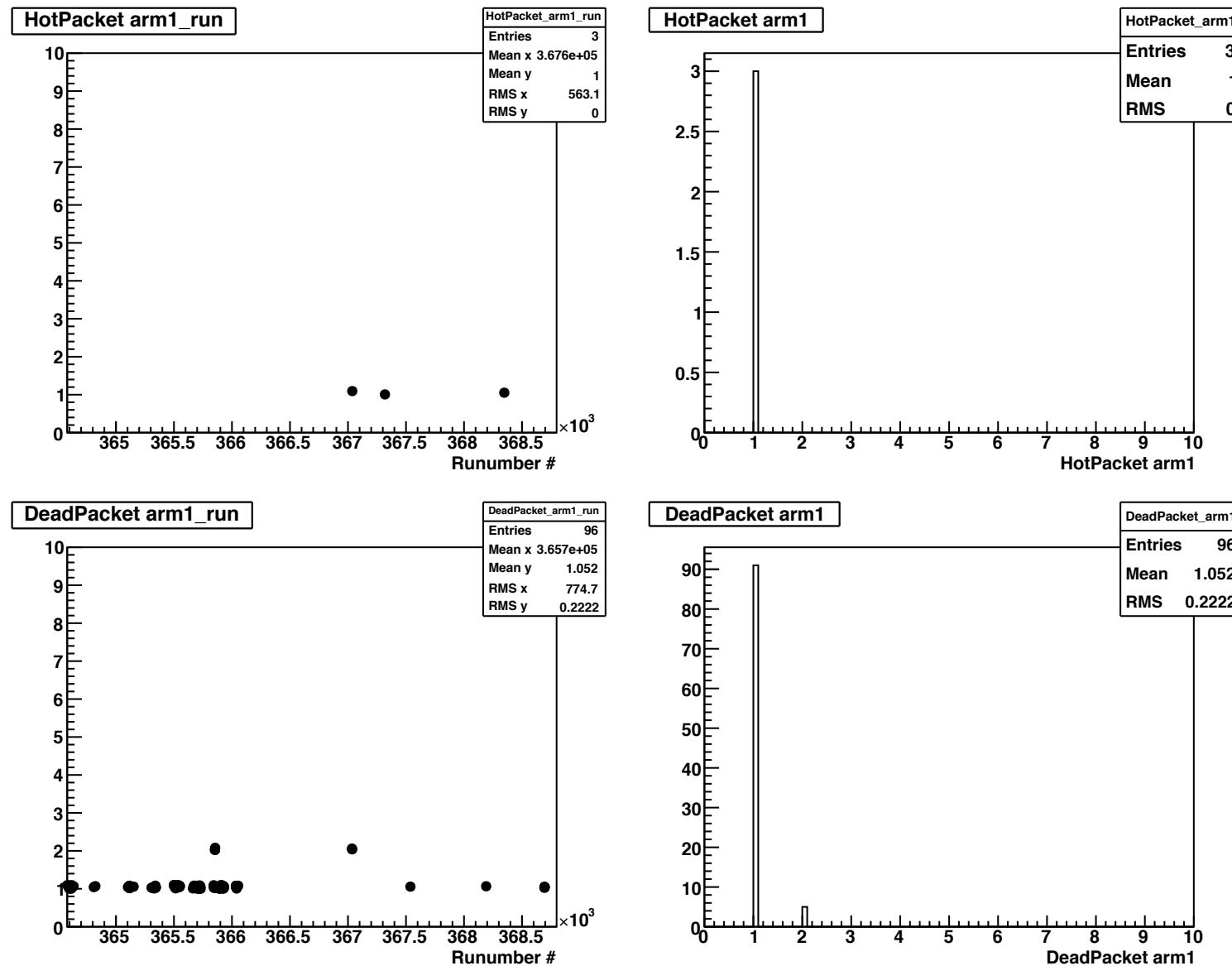
DeadPacket arm0_run

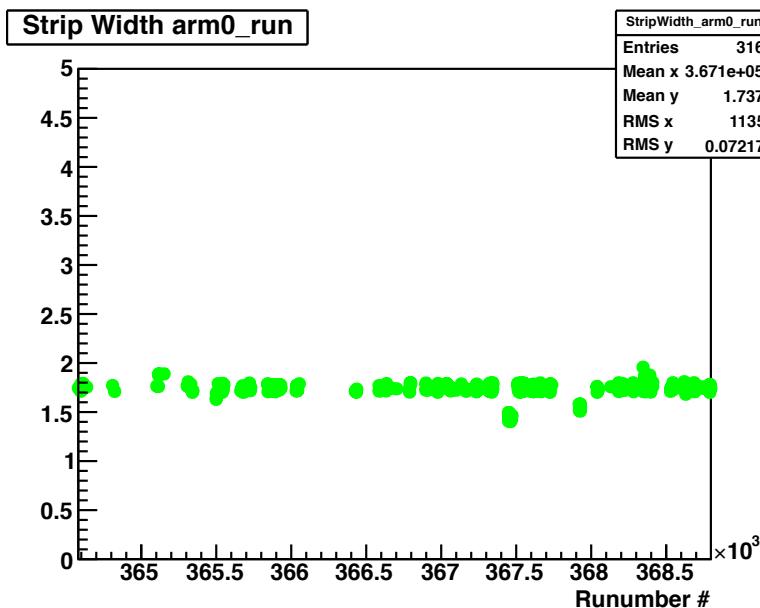


DeadPacket arm0



North-Arm ReadOutError: Flag Hot/Dead Packet >=2

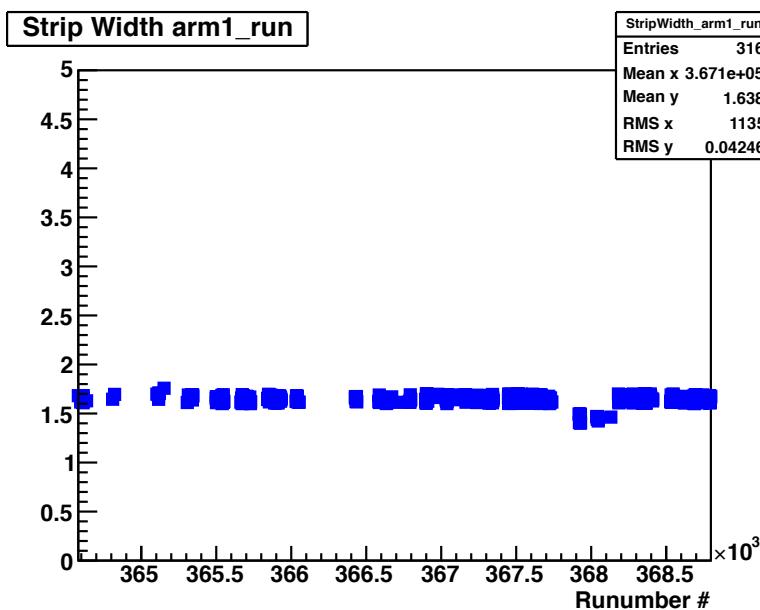




No Further run rejections

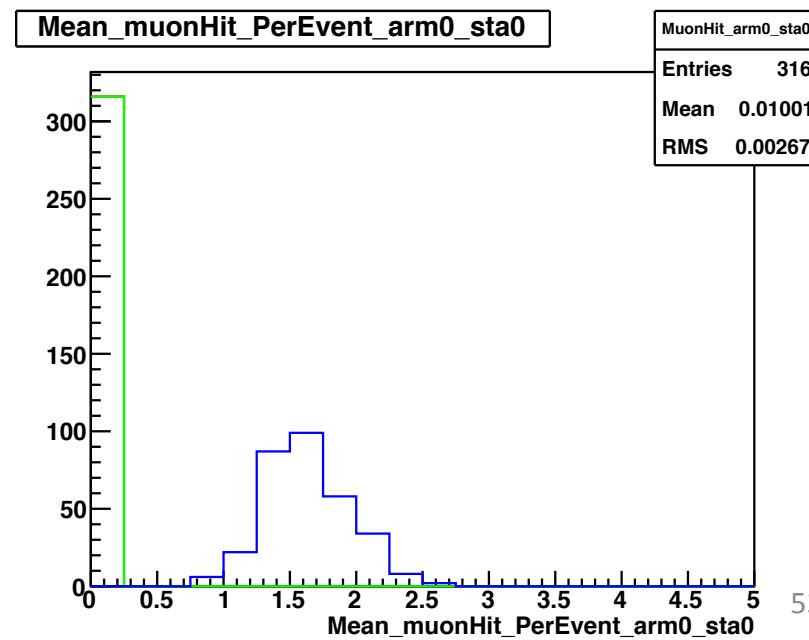
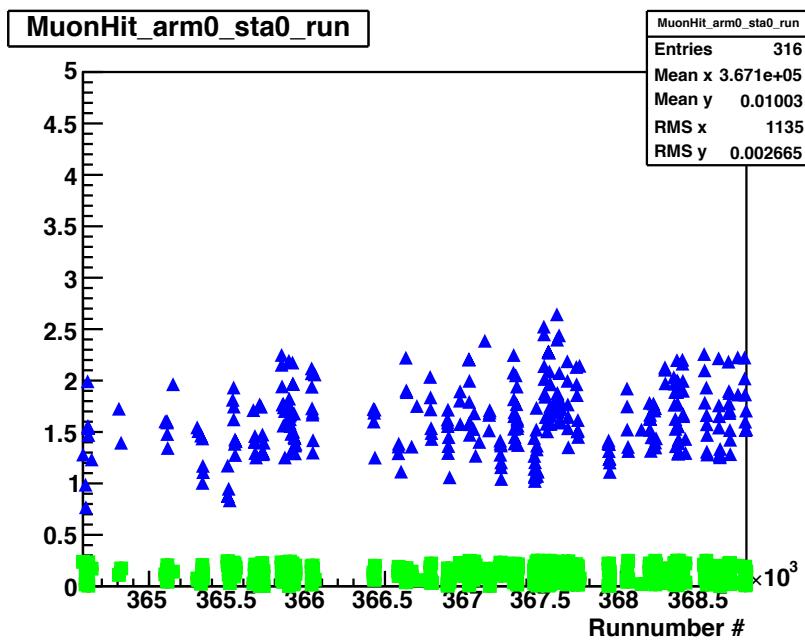
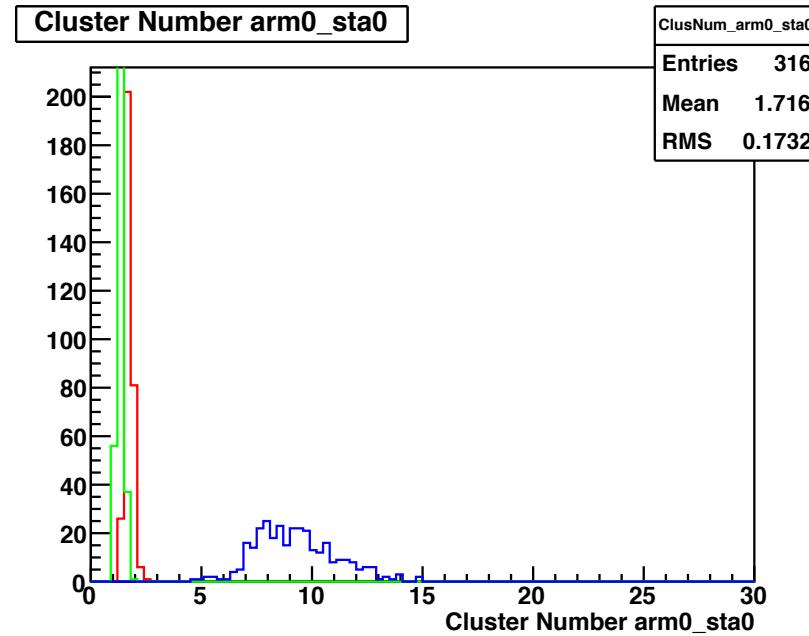
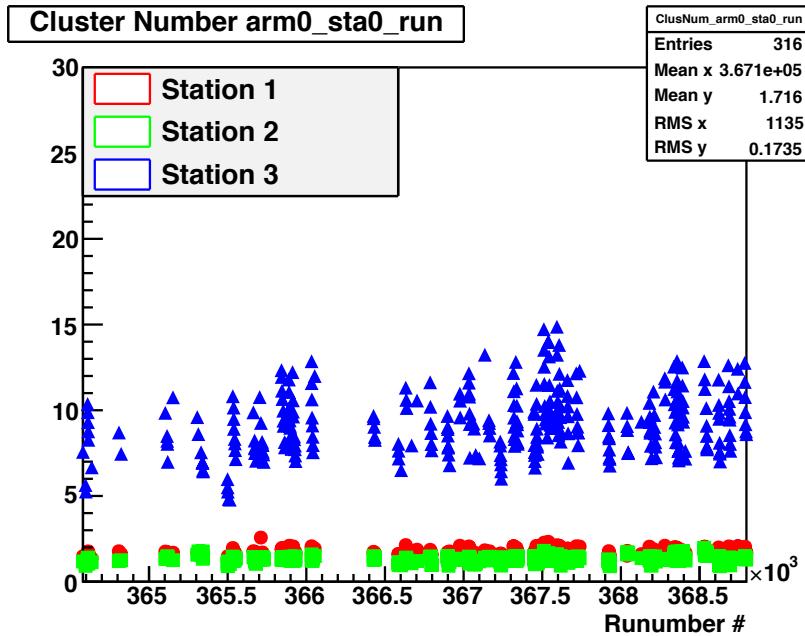
StripWidth
No Runs Flagged

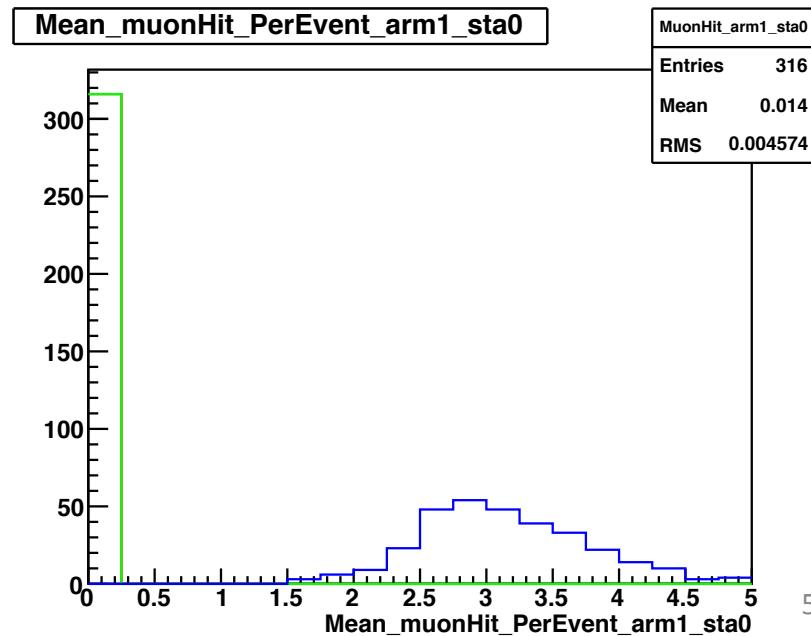
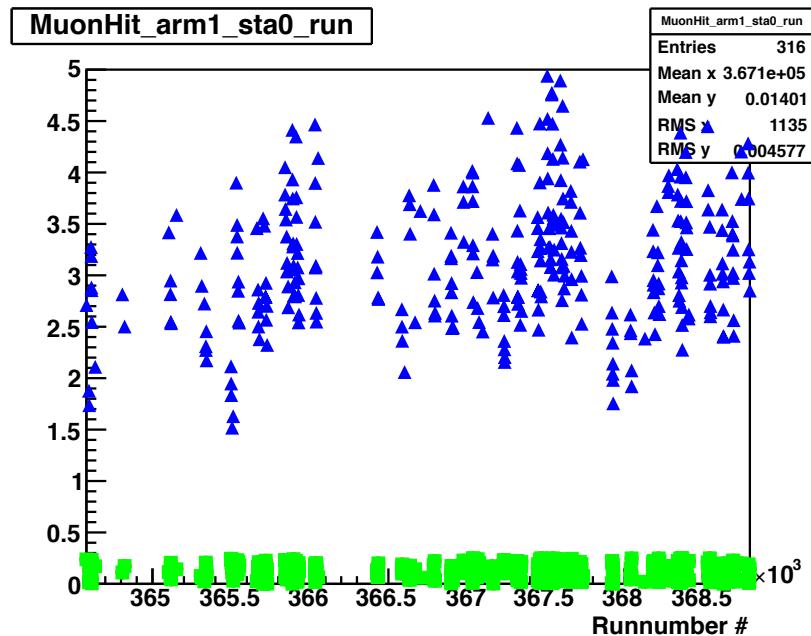
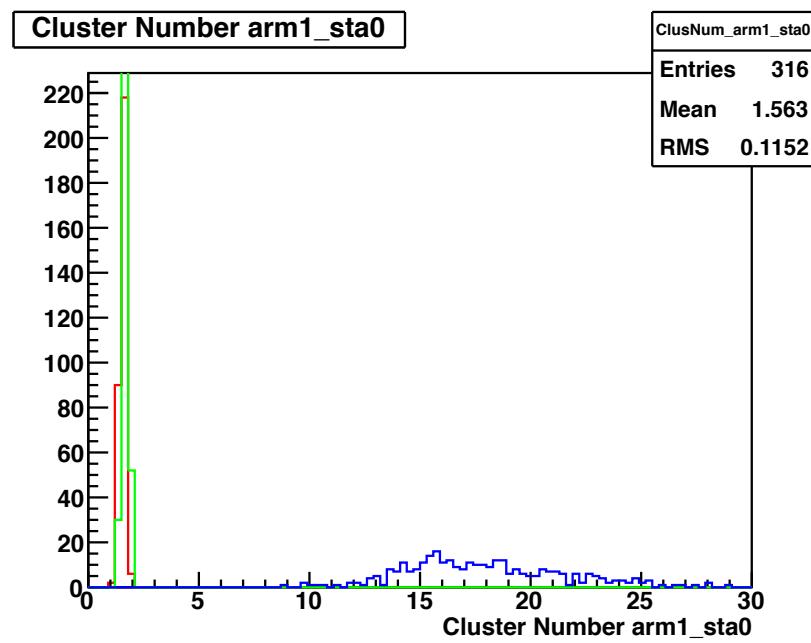
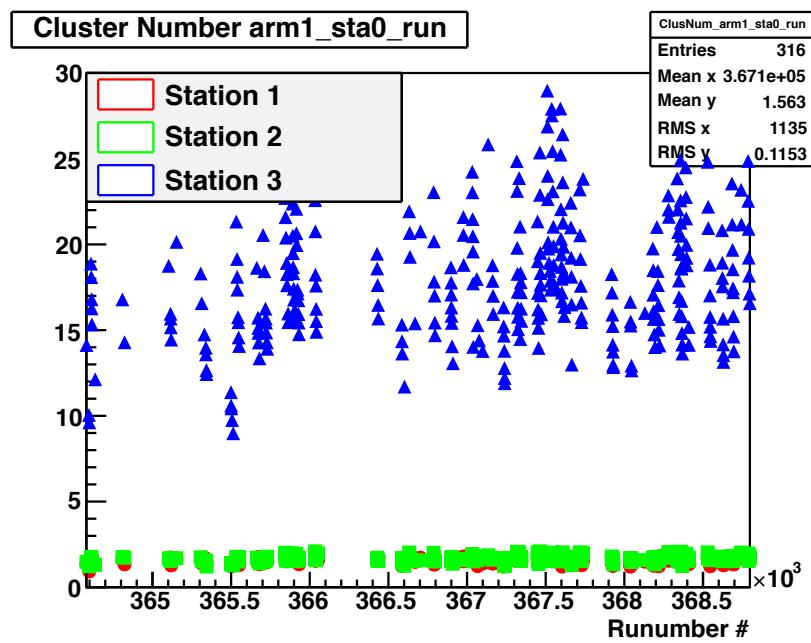
Number-of-Dead-Plane
No Runs Flagged



Number-of-Clusters
No Runs Rejected

Mean-hits
No runs rejected





Run12pp510 GoodRunLists

[https://www.phenix.bnl.gov/phenix/WWW/publish/xjiang/Run12/
Run12pp510/Run12pp510_QA/](https://www.phenix.bnl.gov/phenix/WWW/publish/xjiang/Run12/Run12pp510/Run12pp510_QA/)

South_goodrunlist.txt 283 runs

North_goodrunlist.txt 287 runs

Backup Slides: